MCIC Report/May 1977

MCIC - 77-31

LOW TEMPERATURE PROPERTIES OF SELECTED MATERIALS— A BIBLIOGRAPHY WITH DESCRIPTORS

Metals and Ceramics Information Center
Battelle
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This report is a bibliography of the work reported in the literature on the effects of low temperature on the properties of structural materials. Some of the newer areas of cryogenic technology such as superconducting machinery involve environments which may subject the components to temperature as low as 4 K. Exposure of structural materials to such low temperatures affects their properties. This bibliography contains 963 references published between 1950-1976, arranged in chronological/alphabetical order. Combined material/property indexes are provided.

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This report is a bibliography of the work reported in the literature on the effects of low temperature on the properties of structural materials. Some of the newer areas of cryogenic technology such as superconducting machinery involve environments which may subject the components to temperature as low as 4 K. Exposure of structural materials to such low temperatures affects their properties. This bibliography contains 963 references published between 1950-1976, arranged in chronological/alphabetical order. Combined material/property indexes are provided.

8. This report discusses the work reported in the literature on the low temperature properties of structural materials.
9. This report will be useful to materials engineers, chemical engineers, cryogenic equipment designers, gas engineers.
10. Industries using the information in the report will include electronics, shipbuilding, power equipment, and gas companies.
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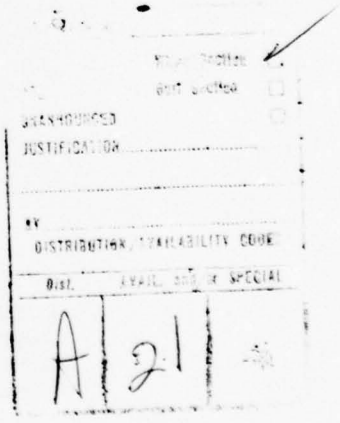

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TABLE OF CONTENTS

INTRODUCTION

PURPOSE

The purpose of this document is to provide a ready reference to pertinent literature related to the effects of low temperatures on the properties of structural materials. One important area of technology which uses materials at low temperatures is superconducting machinery. Advances in the development of superconducting machinery have indicated that superconducting generators, motors, transmission lines, and other electrical equipment are more efficient, occupy less space for equivalent capacity and have other advantages over most conventional equipment. Because of these advantages, there is considerable incentive to develop superconducting systems for certain military, as well as non-military applications. One particularly important area would be transportation systems. Environments involved may expose the components to cryogenic temperature as low as 4 K, which would require considerable new design technology. Exposure of structural materials to such low temperatures definitely affects the properties of the materials of construction.

SCOPE

A bibliography with descriptors is presented on the mechanical, thermal, electrical, and magnetic properties of selected materials at low temperatures. Temperatures which are readily attainable for testing range from +25 C to -269 C are shown in Table 1.

TIME PERIOD

References to 963 documents published between 1950 - 1976 are arranged in a chronological/alphabetical order.

DATA SOURCES

Data sources used for the bibliography include the technical journals listed in Table 2 plus Government-sponsored reports, books, technical symposia, and industrial literature.

ORGANIZATION AND FORMAT

Bibliographic items appear in alphabetical order by year of publication. A continuous numbering system is used throughout the bibliography. The assigned numbers appear as location addresses in all Material/Property Indexes and in the First Author Index.

Descriptors

Descriptors for the bibliographic items are formated as follows: *Special Document Type* (review, compilation, etc.)*/Materials/Specific Properties/Temperature* (lowest reported in a given report).

Descriptor terms for composites are formated in a consistent manner. For the term "fiberglass/epoxy composite", the reinforcing material is fiberglass and appears to the left of the slash mark while the matrix material (epoxy resin) has been placed to the right of the slash mark. Thus, the format for all composite materials is: *(Reinforcement Material)/(Matrix Material).*

Material/Property Indexes

Combined Material/Property Indexes are provided for the convenience of readers. References relating to the mechanical properties of a material are readily identified and completely separated from the thermal, electrical, and magnetic properties of that same material. For example, data for Inconel X-750 is retrievable from four separate indexes:

Material (Inconel X-750)/Mechanical Property Index

Material (Inconel X-750)/Thermal Property Index

Material (Inconel X-750)/Electrical Property Index

Material (Inconel X-750)/Magnetic Property Index

A tabulated summary of material groups and their associated properties is given in Table 3.

In the published literature, research studies on materials are normally reported with various designations, trade names and common usage nomenclature. For consistency, several designations were changed in accordance with accepted international alloy descriptors. Table 4 gives equivalent designations and common usage/trade names for some of the indexed materials.

TABLE 1. CRYOGENIC TEMPERATURE SCALE

Material or Condition	Temperature			
	F	R	C	K
Room Temperature	+ 78	538	+ 25	298.0
Dry Ice and Alcohol	-100	360	- 73	200.0
Oxygen*	-297	163	-183	90.0
Fluorine*	-307	153	-188	85.0
Nitrogen*	-320	140	-195	77.0
Hydrogen*	-423	37	-253	20.0
Helium*	-452	8	-269	4.2
Absolute Zero	-460	0	-273	0.0

* Temperature is boiling point of liquid gas.

TABLE 2. DATA SOURCES

Acta Metallurgica
Acta Physica Polonica
Advances in Cryogenic Engineering
AIAA Journal
Applied Physics
Applied Physics Letters
American Chemical Society
Annalen Der Physik
ASTM Bulletin
ASTM Proceedings
ASTM STP 181
ASTM STP 227
ASTM STP 287
ASTM STP 302
ASTM STP 369
ASTM STP 432
ASTM STP 496
ASTM STP 513
ASTM STP 536
ASTM STP 556
ASTM STP 579
Australian Journal of Physics
Automatic Welding
British Journal of Applied Physics
British Welding Journal
Canadian Journal of Physics
Chemical Engineering
Cryogenic Engineering News
Cryogenic Technology
Cryogenics
Cryogenics and Industrial Gases
Electro-Technology
Elektrotekhnika
Engineering Fracture Mechanics
Experimental Mechanics
Fiz. Metal Metalloved
IEEE Transactions on Magnetics
Industrial Heating
Industrial Laboratory
Insulation
Izv. Akad. Nauk SSSR Metal
Japan Journal of Applied Physics
J. of the Acoustical Society of America
J. of Applied Chemistry
J. of Applied Physics
J. of Applied Polymer Science
J. of Chemical & Engineering Data
J. of Chemical Physics
J. of the Electrochemical Society
J. of the Institute of Metals
J. of the Less Common Metals
J. of Low Temperature Physics
J. of Macromolecular Science - Physics
J. of Materials
J. of Materials Science
J. of Metals
J. of Physical Chemistry
J. of the Physical Society of Japan
J. of Physics F: Metal Phys.
J. of Physics and Chemistry of Solids
J. of Polymer Science
J. of Research of the National Bureau of Standards
J. of Spacecraft and Rockets
J. of Testing and Evaluation
Kolloid Zeitschrift
Light Metal Age
Machine Design
Materials in Design Engineering
Materials Engineering
Materials Research Bulletin
Materials Research & Standards
Materials Science and Engineering
Mechanical Engineering
Metal Industry
Metal Physics
Metal Progress
Metal Science and Heat Treatment
Metallurgical Transactions
Metals Engineering Quarterly
Nature
NBS Circular 520
Norwegian Maritime Research
Nucleonics
Oil and Gas Journal
Philosophical Magazine, Series 7
Philosophical Magazine
Philosophical Magazine, Series 8
Philosophical Transactions of the Royal Society of London
Physica
Physica Status Solidi
Physical Review
Physical Review B
Physical Review Letters
Physics Letters
Physics of Metals and Metallography
Polymer Mechanics
Proceedings of the Academy of Science USSR
Proc. of the Physical Society (London)
Proc. of the Royal Society of London
Review of Scientific Instruments
Reviews of Modern Physics
Russian Engineering Journal
Russian Metallurgy
Science
Scientific American
Scripta Metallurgica
Solid State Communications
Soviet Physics (JETP)
Soviet Physics - Solid State
Soviet Physics Doklady
Space/Aeronautics
SPE Journal
SPE Transactions
Strength of Materials

TABLE 2. (Continued)

Sulzer Technical Review
Trans. of the ASM
Trans. of the ASME
Trans. of the ASME Journal of Basic Engineering
Trans. of the ASME, Journal of Engineering for Industry, Series B
Trans. of the Japanese Institute of Metals
Transportation Engineering Journal
Welding and Metal Fabrication
Welding Design and Fabrication
Welding Journal
Wire and Wire Products
Z. Angew. Phys.
Z. Metallkunde

TABLE 3. MATERIAL AND PROPERTY INDEX SUMMARY

Material Groups	M[a]	T[b]	E[c]	MG[d]	Material Groups	M	T	E	MG
Aluminum	x	x	x	x	Niobium	x	x	x	x
Beryllium	x	x	x		Osmium		x	x	
Bismuth		x			Palladium		x	x	
Cadmium	x	x	x		Platinum		x	x	x
Ceramics		x	x	x	Polymers	x	x	x	x
Chromium	x	x	x	x	Rhenium		x	x	
Cobalt	x	x	x	x	Rhodium		x	x	
Composites		x	x	x	Ruthenium		x	x	
Copper	x	x	x	x	Silicon		x		
Gallium		x			Silver	x	x	x	x
Germanium		x	x	x	Sodium		x	x	
Gold	x	x	x	x	Steel–Engineering	x	x	x	x
Hafnium		x	x		Steel–Stainless	x	x	x	x
Indium		x	x	x	Tantalum	x	x	x	x
Iridium		x	x		Thallium		x	x	x
Iron Alloys	x	x	x	x	Tin	x	x	x	x
Lead	x	x	x		Titanium	x	x	x	x
Magnesium	x	x	x	x	Tungsten		x	x	x
Manganese	x	x	x	x	Uranium		x		
Mercury		x			Vanadium	x	x	x	x
Molybdenum	x	x	x	x	Zinc	x	x	x	x
Nickel	x	x	x	x	Zirconium	x	x	x	

(a) Mechanical properties.

(b) Thermal properties.

(c) Electrical properties.

(d) Magnetic properties.

TABLE 4. EQUIVALENT DESIGNATIONS AND COMMON USAGE/TRADE NAMES FOR INDEXED MATERIALS

Indexed Material	Equivalent Designation	Common Usage (Trade) Names
Aluminum Alloys		
1100 Aluminum	2S	
3003	3S	
2024	24S	
5052	52S	
5154	54S	
6063	64S	
7075	75S	
D20 (Russian)	2219	
HS30 (British)	6061	
D 74S (British)	7005	
L71 (British)	2014	
Hiduminium 48 (British)	7039	
Copper Alloys		
Cu-1.9Be		Beryllium copper
Cu-1.9Be		Beryllium bronze
Cu-1.9Be		Berylco 25
Cu-5Ni-1Fe		Kunifer 5
Cu-10Ni-1Fe		Kunifer 10
Cu-10Ni-1Fe		Cupro-nickel
Cu-20Ni-1Fe		Kunifer 20
Cu-12Mn-7Al-2Ni-2Fe		Superston
Cu-13Mn-4Ni		Manganin
Cu-40Ni		Constantan
Cu-40Zn		Muntz Metal
Cu-40Zn		Brass
Cu-43Ni		Advance
Cu-43Ni		Constantan
Iron Alloys		
Fe-29Ni-17.5Co		Kovar
Fe-36Ni		Invar
Fe-42Ni-1Mn		Dumet
Fe-35Ni		Nilo 36
Fe-51Ni		Nilo 50
Nickel Alloys		
Ni-2Be-0.5Ti		Berylco Nickel 400
Ni-10Cr		Chromel-A
Ni-20Cr		Karma
Ni-20Cr-1Fe		Tophet-A
Ni-20Cr-2.7Al-2.7Cu		Evanohm

TABLE 4. (Continued)

Indexed Material	Equivalent Designation	Common Usage (Trade) Names
Polymers		
Polycarbonate	PC	
Polychlorotrifluoro-ethylene	PCTFE	Kel-F
Polyethylene	PE	
Polyethylene-terephthalate	PET	Mylar
Polymethylmethacrylate	PMM	
Polystyrene	PS	
Polytetrafluoroethylene	PTFE	Teflon
Polyvinylchloride	PVC	
Titanium Alloys		
Ti-4Al-3Mo-1V	RS-115	
Ti-5Al-2.5Sn	A110AT	
Ti-5Al-2.7Cr-1.3Fe	RS-140	
Ti-5.7Mn	C-110M	
Ti-6Al-4V	C120AV	
Ti-6Al-4V	RS-120A	
Ti-13V-11Cr-3Al	B-120VCA	
DTD 5093 (British)	Ti-5Al-2.5Sn	
IMI 318A (British)	Ti-6Al-4V	
DTD 5133 (British)	Ti-2Cu	
Stainless Steel		
17-4PH	AISI 630	
17-7PH	AISI 631	
15-7PH	AISI 632	
AM 350	AISI 633	
L-605	AISI 670	
L-605	Haynes 25	
OKh15N25MT2 (Russian)	A-286	
18/8 Stainless	18Cr-8Ni	
21-6-9	21Cr-6Ni-9Mn	
22-13-5	22Cr-13Ni-5Mn	

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1950

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2. Krivokob, V. N., and Thomas, R. D., Jr., "Impact Tests of Welded Austenitic Stainless Steel", Welding Journal Research Supplement, 29 (9), 493s-495s (September 1950).

   AISI 301; AISI 302; AISI 304; AISI 308; AISI 310; AISI 316; AISI 317; AISI 318; AISI 321; AISI 347; impact properties; weld properties; -320F

3. Teed, P. L., The Properties of Metallic Materials at Low Temperatures, Volume I, John Wiley & Sons, Inc., New York (1950).

   Aluminum; electrical resistivity; ultimate tensile strength; tensile yield strength; elongation; reduction in area

   Aluminum alloys; ultimate tensile strength; tensile yield strength; elongation; reduction in area

   Copper; electrical resistivity; ultimate tensile strength; tensile yield strength; elongation; reduction in area

   Copper alloys; ultimate tensile strength; tensile yield strength; elongation; reduction in area

   Engineering steels; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; modulus of elasticity; fatigue properties; weld properties

   Lead; magnesium alloys; nickel; tin; zinc; ultimate tensile strength; tensile yield strength; elongation reduction in area

1951

4. De Nobel, J., "Heat Conductivity of Steels and a Few Other Metals at Low Temperatures", Physica, 17 (5), 551-562 (May 1951).

   Aluminum; nickel; engineering steel; thermal conductivity

5. Munse, W. H., and Weil, N. A., "Mechanical Properties of Copper at Various Temperatures", American Society for Testing Materials Proceedings, 51, 996-1022 (1951).

   Electrolytic tough pitch copper; phosphorized copper; OFHC copper; tensile yield strength; ultimate tensile strength; reduction in area; elongation; modulus of elasticity; fracture; -400 F

6. Peppiatti, H. J., and Brockhouse, B. N., "The Initial Susceptibility of Nickel Under Tension", Journal of Applied Physics, 22 (7), 985-986 (July 1951).

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   Copper; shear stress; 4.2 K

8. Spretnak, J. W., Fontana, M. G., and Brooks, H. E., "Notched and Unnotched Tensile and Fatigue Properties of Ten Engineering Alloys at 25 C and -196 C", Transactions of the ASM, 43, 547-570 (1951).

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1952

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   18/8 stainless; engineering steel; iron alloys; Cu-9Zn; modulus of elasticity; ultimate tensile strength; elongation; reduction in area; impact properties; fracture properties; -196 C

10. Austin, J. B., "Manufacture of Steels for Low-Temperature Service", NBS Circular 520, 36-47 (May 7, 1952).

    AISI 1022; AISI 2317; 12Cr steel; impact properties; notch toughness; -315 F

11. Bowen, D., Eggleston, R. R., and Kropschot, R. H., "A Study of the Annealing Kinetics in Cold Worked Copper", Journal of Applied Physics, 23 (6), 630-634 (June 1952).

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    Armco iron; impact properties; weld properties; -120 C

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    Copper; electrical resistivity; 4.2 K

14. Estermann, I., and Zimmerman, J. E., "Heat Conduction in Alloys at Low Temperatures", Journal of Applied Physics, 23 (5), 578-588 (May 1952).

    Cu-10Ni; Monel 400; Inconel 600; AISI 303; AISI 347; thermal conductivity; 4.2 K

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Polytetrafluoroethylene; thermal properties; specific heat; 5 K

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AISI 2330; AISI 4340; AISI 8630; 18/8 stainless; aluminum alloys; 2024-T4; 7075-T6; magnesium alloys; titanium; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; notch tensile strength; impact properties; fatigue properties; -320 F

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AISI 301; AISI 302; AISI 303; AISI 304; AISI 310; AISI 316; AISI 317; AISI 321; AISI 347; AISI 410; AISI 430; 18/8 stainless; modulus of elasticity; impact properties; notch tensile strength; fatigue properties; -320 F

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Engineering steel; AISI 1095; brittle fracture; fracture properties; -283 F

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Iron alloys; Fe-0.49C; stress-strain data; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -185 C

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1954

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Niobium; superconductivity; specific heat; 2.5 K

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Copper; tensile properties; 20 K

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Copper; thermal conductivity; 4.2 K

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1954

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1955

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Brass; beryllium copper; thermal conductivity; 2 K

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Aluminum; copper; thermal expansion; 20 K

40. Howling, D. H., Mendoza, E., and Zimmerman, J. E., "Preliminary Experiments on the Temperature-Wave Method of Measuring Specific Heats of Metals at Low Temperatures", Proceedings of the Royal Society of London, A229 (1176), 86-109 (April 5, 1955).

Aluminum; copper; specific heat; thermal conductivity; 1 K

41. Johnston, H. L., Powers, R. W., Altman, H. W., Rubin, T., and Mattox, R. W., "Accurate Measurement of Certain Physical Properties Down to 20 K", Proceedings of the 1954 Cryogenic Engineering Conference, 194-195 (1955).

AISI 304; thermal conductivity; 20 K

42. Kropschot, R. H., "The Mechanical Properties Testing Program at the NBS-AEC Cryogenic Engineering Laboratory", Proceedings of the 1954 Cryogenic Engineering Conference, 164-169 (1955).

Aluminum alloys; AISI 303; AISI 310; AISI 316; Monel 400; ultimate tensile strength; tensile yield strength; elongation; reduction in area; 20 K

43. Park, O. E., Fulk, M. M., and Reynolds, M. M., "Low Temperature Electrical Resistance of Fifteen Commercial Conductors", Proceedings of the 1954 Cryogenic Engineering Conference, 101-102 (1955).

AISI 304; copper; copper alloys; Manganin (Cu-13Mn-4Ni); Cupron (Cu-45Ni); nickel; nickel alloys; Chromel-A (Ni-2Cr); Evanohm (Ni-20Cr-2.7Al-2.7Cu); Tophet-A (Ni-20Cr-1Fe); gold; silver; platinum; lead; electrical resistivity; 19.7 K

44. Powell, R. L., and Coffin, D. O., "Thermal Conductivity of Solids at Low Temperatures", Proceedings of the 1954 Cryogenic Engineering Conference, 189-193 (1955).

Copper; thermal conductivity; 20 K

45. Powell, R. L., and Coffin, D. O., "Low-Temperature Thermal Conductivity of a Free-Machining Copper", Review of Scientific Instruments, 26 (5), 516 (May 1955).

OFHC copper; thermal conductivity; 20 K

46. Swenson, C. A., "The Compressive Strengths of Some Technical Metals Between 4.2 and 300 K", Proceedings of the 1954 Cryogenic Engineering Conference, 179-182 (1955).

AISI 1020; AISI 303; AISI 304; AISI 440; compressive yield strength; 4.2 K

47. Waldron, C. R., "Mechanical Properties of 356-T6 Cast Aluminum Alloy, AZ91C-T4 Cast Magnesium Alloy, and AZ91C-T6 Cast Magnesium Alloy at Room Temperature and -300 F", Technical Report AL-2158, North American Aviation, Inc. (June 1955).

Casting alloys; aluminum alloys; 356-T6; magnesium alloys; AZ91C-T4; AZ91C-T6; ultimate tensile strength; tensile yield strength; elongation; reduction in area; compressive yield strength; impact properties; -300 F

1956

48. Allison, F. E., and Pugh, E. M., "Temperature Dependence of the Hall Coefficients in Some Copper-Nickel Alloys", Physical Review, 102 (5), 1281-1287 (June 1, 1956).

Ni-40Cu; Ni-30Cu; Ni-20Cu; magnetization; 64 K

49. Aven, M. H., Craig, R. S., Waite, T. R., et al, "Heat Capacity of Titanium Between 4 and 15 K", Physical Review, 102 (5), 1263-1264 (June 1, 1956).

Titanium; thermal properties; specific heat; 4 K

50. Bowers, R., "Magnetic Susceptibility of Copper Metal at Low Temperatures", Physical Review, 102 (6), 1486-1488 (June 15, 1956).

Copper; magnetic susceptibility; 1 K

51. Collins, S. C., Ezekiel, F. C., Sepp, O. W., and Rizika, J. W., "The Strength of Certain Stainless and Carbon Steels at Low Temperatures", American Society for Testing Materials Proceedings, 56, 687-703 (1956).

AISI 1018; AISI 302; AISI 303; AISI 310; AISI 416; tensile yield strength; elongation; stress-strain data; fracture properties; 10 K

52. Kemp, W.R.G., Klemens, P. G., and White, G. K., "Thermal and Electrical Conductivities of Iron, Nickel, Titanium, and Zirconium at Low Temperatures", Australian Journal of Physics, 9 (2), 180-188 (June 1956).

Iron; nickel; zirconium; titanium; electrical resistivity; thermal conductivity; 2 K

53. Rayne, J. A., "The Heat Capacity of Copper Below 4.2 K", Australian Journal of Physics, 9 (2), 189-197 (June 1956).

Copper; Cu-1Cd; specific heat; 4.2 K

54. Ripling, E. J., "Notch Tensile Behavior of Face Centered Cubic Metals", American Society for Testing Materials Proceedings, 56, 662-671 (1956).

AISI 310; 2024-T6; 7075-T6; Monel 400; nickel; copper; notch tensile strength; -321 F

55. Upthegrove, C., and Burghoff, H. L., "Elevated-Temperature Properties of Coppers and Copper-Base Alloys", ASTM Special Technical Publication No. 181 (1956).

Deoxidized copper; OFHC copper; electrolytic tough pitch copper; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; -321 F

1957

56. Kemp, W.R.G., Klemens, P. G., Tainsh, R. J., and White, G. K., "The Electrical and Thermal Conductivities of Some Brasses at Low Temperatures", ACTA Metallurgica, 5 (6), 303-309 (June 1957).

Cu-2Zn; Cu-5Zn; Cu-10Zn; Cu-20Zn; Cu-30Zn; thermal conductivity; electrical conductivity; 2 K

57. Los, G. J., and Gerritsen, A. N., "Resistance and Magneto-Resistance of Dilute Alloys of Copper and Gold With Nickel at Low Temperatures", Physica, 23, 633-640 (1957).

Copper; Cu-2Ni; magnetoresistance; electrical resistivity; 1.2 K

58. McCammon, R. D., and Rosenberg, H. M., "The Fatigue and Ultimate Tensile Strengths of Metals Between 4.2 and 293 K", Proceedings of the Royal Society (London), 203-211 (1957).

Aluminum; copper; gold; iron; magnesium; silver; zinc; ultimate tensile strength; fatigue properties; 4.2 K

59. Powell, R. L., Roder, H. M., and Rogers, W. M., "Low-Temperature Thermal Conductivity of Some Commercial Coppers", Journal of Applied Physics, 28 (11), 1282-1288 (November 1957).

Electrolytic tough pitch copper; phosphorized copper; OFHC copper; high purity copper; thermal conductivity; 4 K

60. Pugh, E. W., Coles, B. R., Arrott, A., and Goldman, J. E., "Magnetic Susceptibility of Dilute Alloys of Nickel in Copper Between 2.5 K and 295 K", Physical Review, 105 (3), 814-818 (February 1, 1957).

Copper; Cu-1Ni; Cu-2.5Ni; magnetic susceptibility; 2.5 K

61. Rayne, J. A., "Heat Capacity of Alpha Brasses Below 4.2 K", Physical Review, 108 (1), 22-25 (October 1, 1957).

Cu-1.5Zn; Cu-3Zn; Cu-6Zn; Cu-8Zn; Cu-10Zn; Cu-20Zn; Cu-24.5Zn; Cu-29Zn; Cu-33Zn; specific heat; 4.2 K

62. Smith, R. L., and Rutherford, J. L., "Tensile Properties of Zone Refined Iron in the Temperature Range From 298 to 4.2 K", Journal of Metals, 9 (7), 857-864 (July 1957).

Iron; tensile properties; 4.2 K

63. Van Itterbeek, A., and Duchateau, W., "Measurements on the Magnetic Susceptibility of White Tin and Copper Down to Liquid Helium Temperatures", Physica, 23, 169-172 (1957).

Copper; tin; magnetic susceptibility; 2 K

64. Wessel, E. T., "Some Exploratory Observations of the Tensile Properties of Metals at Very Low Temperatures", Transactions of the ASM, 49, 149-172 (1957).

AISI 1020; AISI 335; AISI 4340; Cu-49Zn; molybdenum; nickel; tantalum; zirconium; ultimate tensile strength; tensile yield strength; elongation; reduction in area; stress-strain data; 4.2 K

1958

65. DeSorbo, W., "Quenched Imperfections and the Electrical Resistivity of Aluminum at Low Temperatures", Physical Review, 111 (3), 810-812 (August 1, 1957).

Aluminum; electrical resistivity; 1 K

66. Durham, R. J., "Extruded Aluminum Alloys for Low Temperature Service. An Assessment of the Suitability of Two Materials", British Welding Journal, 5 (11), 510-516 (November 1958).

Aluminum alloys; Noral 505; Noral 545; British alloys; proof stress; ultimate tensile strength; elongation; brittle fracture; weld properties; -196 C

67. Dyment, J., and Ziebland, H., "The Tensile Properties of Some Plastics at Low Temperatures", Journal of Applied Chemistry, 8, 203-206 (April 1958).

Polytetrafluoroethylene; ultimate tensile strength; modulus of elasticity; -196 C

68. Lismer, R. E., "Low Temperature Properties of Aluminum-Magnesium Alloys", British Welding Journal, 5 (11), 523-538 (November 1958).

Aluminum alloys; 5083; 5356; British alloys; notch tensile strength; fracture properties; -196 C

69. Lucks, C. F., and Deem, H. W., "Thermal Properties of Thirteen Metals", American Society for Testing Materials, ASTM Special Technical Publication No. 227 (February 1958).

AISI 1010; AISI 301; AISI 316; AISI 347; aluminum alloys; 2024-T4; 7075-T6; chromium; copper; Inconel 600; Inconel X-750; magnesium; molybdenum; Monel alloy K-500; thermal conductivity; thermal expansion; specific heat; -250 F

70. McGee, R. L., and Campbell, J. E., "The Mechanical Properties of Certain Aircraft Structural Metals at Very Low Temperatures", Technical Report ASD-TR-58-386, Battelle Memorial Institute (November 1958).

Aluminum alloys; 7079-T6; magnesium alloys; ZK60A-T5; engineering steel; AISI 4340; 300M; stainless steel; AM350; 17-7PH; titanium alloys; Ti-5Al-2.5Sn; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; hardness; -423 F

71. Pugh, E. W., and Ryan, F. M., "Magnetic Susceptibility of Copper-Nickel and Silver-Palladium Alloys at Low Temperatures", Physical Review, 111 (4), 1038-1042 (August 15, 1958).

Copper; Cu-2.3Ni; Cu-4.6Ni; Cu-9.9Ni; Cu-17Ni; Cu-26.9Ni; silver; Ag-2Pd; Ag-10Pd; magnetic susceptibility; 4.2 K

1959

72. Armstrong, T. N., Gross, J. H., and Brien, R. E., "Properties Affecting Suitability of 9 percent Nickel Steel for Low-Temperature Service", Welding Journal Research Supplement, 38, 57-s through 70-s (February 1959).

9Ni steel; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; weld properties; -320 F

73. Baughman, R. A., "Gas Atmosphere Effects on Materials", Final Report, R59FPD456, General Electric Company, WPAFB Contract AF 33(616)-5667 (June 15, 1959).

Stainless steel; AISI 302; AISI 316; 17-7PH; aluminum alloys; 6061; titanium alloys; Ti-5Al-2.5Sn; nickel alloys; R-41; beryllium copper (Cu-2Be); ultimate tensile strength; tensile yield strength; elongation; reduction in area; weld properties; impact properties; -423 F

74. Guthrie, G. L., Friedberg, S. A., and Goldman, J. E., "Specific Heats of Some Copper-Rich Copper-Nickel Alloys at Liquid Helium Temperatures", Physical Review, 113 (1), 45-48 (January 1, 1959).

Copper alloys; Cu-10Ni; Cu-25Ni; Cu-35Ni; Cu-40Ni; specific heat; 4 K

75. Holden, F. C., Schwartzberg, F. R., and Ogden, H. R., "Tensile Properties of Titanium Alloys at Low Temperatures", DMIC Report 107, Battelle Memorial Institute (January 15, 1959).

Ti-6Al-4V; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

76. MacCrone, R. K., McCammon, R. D., and Rosenberg, H. M., "The Fatigue of Metals at 1.7 K", Philosophical Magazine, 4, 267-268 (1959).

OFHC copper; cadmium; fatigue properties; 1.7 K

77. McClintock, R. M., Van Gundy, D. A., and Kropschot, R. H., "Low-Temperature Tensile Properties of Copper and Four Bronzes", ASTM Bulletin, (240), 47-50 (September 1959).

OFHC copper; copper alloys; beryllium bronze (Cu-1.9Be); beryllium cobalt bronze (Cu-2.6Co-0.51Be); silicon bronze (Cu-3Si); phosphor bronze (Cu-8Sn); ultimate tensile strength; tensile yield strength; elongation; reduction in area; 20 K

78. Phillips, N. E., "Heat Capacity of Aluminum Between 0.1 K and 4.0 K", Physical Review, 114 (3), 676-685 (May 1, 1959).

Aluminum; specific heat; 0.1 K

79. Powell, R. L., Roder, H. M., and Hall, W. J., "Low-Temperature Transport Properties of Copper and Its Dilute Alloys: Pure Copper, Annealed and Cold-Drawn", Physical Review, 115 (2), 314-323 (July 15, 1959).

Copper; thermal conductivity; electrical resistivity; 4 K

80. Rayne, J. A., "Elastic Constants of Alpha-Brasses: Variation With Solute Concentration From 4.2 - 300 K", Physical Review, 115 (1), 63-66 (July 1, 1959).

Copper; copper alloys; brass; Cu-4Zn; Cu-9Zn; Cu-17Zn; Cu-23Zn; elastic properties; 4.2 K

81. Scott, R. B., "Low-Temperature Properties of Structural Materials", Cryogenic Engineering, Chapter X, 322-352, D. Van Nostrand Co., Inc., New York (1959).

1100 aluminum; aluminum alloys; 2024; 5052; 6061; copper; leaded brass (Cu-40Zn-14Pb); nickel; Inconel 600; Monel 400; monel alloy K-500; AISI 304; AISI 347; ultimate tensile strength; tensile yield strength; 4 K

Polytetrafluoroethylene (Teflon); polytrifluoromonochloroethylene (Kel-F); polyethylene; polyvinylchloride; nylon; polyethylene terephthalate (Mylar); ultimate tensile strength; compressive yield strength; modulus of elasticity; 4 K

Aluminum; copper; chromium; iron; magnesium; manganese; nickel; 18/8 stainless; Monel 400; fused silica; pyrex; Teflon; specific heat; 20 K

Aluminum; copper; magnesium; nickel; titanium; zinc; AISI 1020; AISI 304; Monel 400; Inconel 600; thermal expansion; 40 K

AISI 304; Manganin (Cu-13Mn-4Ni); Cupron (Cu-45Ni); Chromel-A (Ni-20Cr); Evanohm (Ni-20Cr-2.7Al-2.7Cu); Tophet-A (Ni-20Cr-1Fe); electrical resistivity; 20 K

82. Sekula, S. T., "Resistance Minimum and Resistivity of Copper at Low Temperatures", Physical Review Letters, 3 (9), 416-418 (November 1, 1959).

Copper; electrical resistivity; 1.7 K

83. White, G. K., and Woods, S. B., "Electrical and Thermal Resistivity of the Transition Elements at Low Temperatures", Philosophical Transactions of the Royal Society of London, A251 (995), 273-302 (1959).

Chromium; cobalt; copper; gold; hafnium; iridium; iron; manganese; molybdenum; nickel; niobium; osmium; palladium; platinum; rhenium; rhodium; ruthenium; silver; sodium; tantalum; titanium; tungsten; vanadium; zirconium; electrical resistivity; thermal conductivity; 2 K

1960

84. "Properties of Titanium Alloys at Cryogenic Temperatures", Convair-Astronautics/General Dynamics, Paper presented at the MAB Meeting (January 1960).

Titanium alloys; Ti-5Al-2.5Sn; Ti-2.7Cr-1.3Fe; Ti-6Al-4V; Ti-6Al-4Zr-1V; Ti-7Al-12Zr; Ti-13V-11Cr-3Al; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; weld properties; -423 F

85. "Tensile Data on Ti-6Al-4V Specimens Tested at Liquid Hydrogen Temperature and -423 F", Technical Enclosures, Douglas Aircraft Company (November 29, 1960).

Titanium alloys; Ti-6Al-4V; ultimate tensile strength; elongation; reduction in area; weld properties; -423 F

86. Barron, R. F., "Low-Temperatures Properties of Engineering Materials", Machine Design, 32 (6), 189-195 (March 17, 1960).

1100 aluminum; copper; Inconel 600; Monel 400; AISI 1020; AISI 1040; AISI 304; AISI 347; Teflon; ultimate tensile strength; tensile yield strength; elongation; impact properties; thermal conductivity; -422 F

87. Belton, J. H., Godby. L. L., and Taft, B. L., "Materials for Use at Liquid Hydrogen Temperature", ASTM Special Technical Publication No. 287, 108-121 (June 30, 1960).

Aluminum alloys; 355-T6; 355-T61; 2014-T6; 2024-T4; 6061-T6; 7075-T6; copper alloys; Berylco 10 (Cu-2Co-0.5Be); berylco 25 (Cu-1.9Be);iron-silicon bronze (Cu-3Si-2.8Zn-1.5Fe); nickel alloys; Inconel X-750; Inco 72; Waspalloy; Hastelloy X; titanium alloys; Ti-6Al-4V; Ti-5Al-2.5Sn; iron alloys; N-155; engineering steel; AISI 9310; stainless steel; A-286; Teflon; Kel-F; ultimate tensile strength; tensile yield strength; elongation; reduction in area; hardness; thermal expansion; -423 F

88. Bulow, C. L., "Copper and Its Alloys for Low Temperatures Versatility", Chemical Engineering, 67 (19), 187-192 (September 19, 1960).

Electrolytic tough pitch copper. OFHC copper; aluminum bronze (Cu-7.3Al-1Zn); silicon bronze (Cu-3Si); beryllium copper (Cu-1.9Be); brass (Cu-30Zn, Cu-40Zn, Cu-38Zn-1Sn); cupro nickel (Cu-20Ni, Cu-45Ni); nickel silver (CU-18.7Zn-17Ni); phosphor bronze (Cu-4Sn); ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; impact properties; -423 F

Electrolytic tough pitch copper; thermal conductivity; -452 F

89. Cataldo, C. E., "The Effects of Liquid Hydrogen on Mechanical Properties of Materials", Technical Report DSN-TN3-60, Redstone Arsenal (March 1960).

Aluminum alloys; 2024-T4; 2024-T6; 5086; 7075-T6; nickel alloys; Monel 400; titanium alloys; Ti-2Cr-2Fe-2Mo; Ti-8Mn; Ti-5Al-2.5Sn; engineering steel; AISI 1020; 300M; stainless steel; AISI 303; AISI 304; AISI 440; 17-7PH; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; compressive yield strength; modulus of elasticity; impact properties; -423 F

Aluminum alloys; 2024-T4; 7075-T6; thermal expansion; -423 F

Engineering steel; AISI 1020; AISI 1095; stainless steel; AISI 304; AISI 410; thermal conductivity; -423 F

90. Christian, J. L., and Watson, J. F., "Mechanical Properties of Inconel X Sheet at 78, -100, -320, and -423 F", Technical Report MRG-150, Convair-Astronautics/General Dynamics (April 20, 1960).

Inconel X-750; AISI 321; ultimate tensile strength; tensile yield strength; notch tensile strength; brittle fracture; -423 F

91. Christian, J. L., "Mechanical Properties of Titanium and Titanium Alloys at Cryogenic Temperatures", Technical Report MRG-189, Convair-Astronautics/General Dynamics (October 14, 1960).

Titanium; Ti-5Al-2.75Cr-1.25Fe; Ti-5Al-2.5Sn; Ti-5Al-5Zr-5Sn; Ti-6Al-4V; Ti-6Al-4Zr-1V; Ti-13V-11Cr-3Al; Ti-7Al-12Zr; Ti-8Al-2Cb-1Ta; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; weld properties; impact properties; -423 F

92. Christian, J. L., "Mechanical Properties of Aluminum Alloys at Cryogenic Temperatures", Technical Report MRG-190, Convair-Astronautics/General Dynamics (December 2, 1960).

Aluminum alloys; 2014-T6; 2024-T3; 2024-T4; 2219-T4; 2219-T81; 2219-T87; 5052-H38; 5086-H34; 5086-H38; 5154-H38; 5456-H343; 6061-T4; 6061-T6; 7075-T6; 7079-T6; 7178-T6; X7275-T6; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; weld properties; -423 F

93. Corruccini, R. J., and Gniewek, J. J., "Specific Heats and Enthalpies of Technical Solids at Low Temperatures", NBS Monograph 21 (October 3, 1960).

Literature compilation; aluminum; beryllium; bismuth; cadmium; chromium; copper; germanium; gold; indium; iron; lead; magnesium; manganese; mercury; molybdenum; nickel; niobium; palladium; platinum; rhodium; silicon; silver; sodium; tantalum; tin; titanium; tungsten; zinc; Cu-40Ni; Monel 400; graphite; polyethylene; Teflon; specific heat; 1 K

94. DeMoney, F. W., and Wolfer, G. C., "The Fatigue Properties of Aluminum Alloys 5083-H113 Plate and Butt Weldments at 75 F and -300 F", Paper presented at the 1960 Cryogenic Engineering Conference, Boulder, Colorado (August 1960).

Aluminum alloys; 5083-H113; fatigue properites; weld properties; -300 F

95. DeSisto, T. S., "The True-Stress True-Strain Properties of Titanium and Titanium Alloys as a Function of Temperature and Strain Rate", Technical Report WAL TR-405.2/4, Watertown Arsenal (March 1960).

Titanium; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-7Mn; ultimate tensile strength; elongation; reduction in area; strain rate; true stress; true strain; -319 F

96. Espey, G. B., Jones, M. H., and Brown, W. F., Jr., "Sharp-Edge-Notch Tensile Characteristics of Several High-Strength Titanium Sheet Alloys at Room and Cryogenic Temperatures", ASTM Special Technical Publication No. 287, 74-107 (June 30, 1960).

Ti-4Al-3Mo-1V; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-8Mn; Ti-13V-11Cr-3Al; Ti-16V-2.5Al; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

97. Garber, M., Henry, W. G., and Hoeve, H. G., "A Magnetic Susceptibility Balance and the Temperature Dependence of the Magnetic Susceptibility of Copper, Silver, and Gold, 295-975 K", Canadian Journal of Physics, 38, 1595-1613 (1960).

Copper; silver; gold; magnetic susceptibility; 295 K

Copper; magnetic susceptibility; below 295 K

98. Hall, W. J., Powell, R. L., and Roder, H. M., "Thermal Conductivities of Common Commercial Aluminum Alloys", Proceedings of the 1957 Cryogenic Engineering Conference, 408-415 (1960).

1100 aluminum; aluminum alloys; 6063-T5; 3003; 5052-0; 5154-0; 2024-T4; thermal conductivity; electrical resistivity; 4 K

99. Hanson, M. P., Stickley, G. W., and Richards, H. T., "Sharp-Notch Behavior of Some High-Strength Sheet Aluminum Alloys and Welded Joints at 75, -320, and -423 F", ASTM Special Technical Publication No. 287 (June 1960).

Aluminum alloys; 2014-T6; 2216-T62; 5456-H321; 6061-T6; 7075-T6; 7079-T6; 7178-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

100. Johnson, A. A., "The Low Temperature Tensile Properties of Niobium", Acta Metallurgica, 8, 737-740 (1960).

Niobium, tensile yield strength; elongation; 76 K

101. Johnson, E. W., "Aluminum Alloys: Tough and Ductile Down to -423 F", Chemical Engineering, 67 (16), 133-136 (August 8, 1960).

Aluminum alloys; 3003-0; 5052-H32; 5086-H32; 5083-0; 5154-H34; 5454-H32; 5456-H321; 6061-T6; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

102. Johnson, R. J., "Nickel Steel Alloys for Liquids at -320 F, 9% Excels.", Chemical Engineering, 67 (15), 115-118 (July 25, 1960).

9Ni steel; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; weld properties; thermal expansion; thermal conductivity; -320 F

103. Johnson, V. J., "A Compendium of the Properties of Materials at Low Temperatures (Phase I). Part II. Properties of Solids", WADD-TR-60-56, Part II, NBS, WPAFB Contract AF 33(616)-58-4 (October 1960).

Aluminum; copper; nickel; niobium; zinc; specific heat; thermal expansion; thermal conductivity

104. Kaufman, J. G., "Mechanical Properties of Plain and Welded 6061 Aluminum Alloy at Subzero Temperatures", Technical Report 9-60-26, Aluminum Company of America (July 1960).

Aluminum alloys; 6061-0; 6061-T4; 6061-T6; 6061-T91; ultimate tensile strength; tensile yield strength; elongation; reduction in area; weld properties; notch tensile strength; modulus of elasticity; -423 F

105. Kaufman, J. G., "Effect of Prolonged Exposure at Subzero Temperatures on Tensile Properties of Aluminum Alloys", Technical Report 9-60-41, Aluminum Company of America (December 1960).

Aluminum alloys; 5454-0; 5454-H34; ultimate tensile strength; tensile yield strength; elongation; -320 F

106. Klemens, P. G., "Thermal Expansion of Aluminum at Low Temperatures", Physical Review, 120 (3), 843-844 (November 1, 1960).

Aluminum; thermal expansion; 20 K

107. Kropp, C. J., and Foor, E. R., "Mechanical Properties of Heat Treated A-286 Alloy at Various Testing Temperatures, Status Report No. 3", Technical Report MRG–157, Convair-Astronautics/General Dynamics (June 8, 1960).

Stainless steel; A-286; ultimate tensile strength; tensile yield strength; notch tensile strength; -423 F

108. Kropschot, R. H., McClintock, R. M., and Van Gundy, D. A., "Mechanical Properties of Some Engineering Materials Between 20 and 300 K", Advances in Cryogenic Engineering, 2, 93-99, 1956 Conference (1960).

2024-T3; 2024-T4; 5052-H34; 5054-H32; 6061-T6; 7075-T6; OFHC copper. Berylco 25; Berylco 10; AISI 304; AISI 308; AISI 347; AISI 302; ultimate tensile strength; tensile yield strength; impact properties; 20 K

109. Langston, M. E., and Lund, C. H., "Physical Properties of Some Nickel-Base Alloys", DMIC Report 129, Battelle Memorial Institute (May 20, 1960).

Monel 400; Monel Alloy K-500; Inconel 600; Nimonic 80A; Inconel X-750; specific heat; 4.2 K

Monel 400; Monel Alloy K-500; Inconel 600; Nimonic 75; Nimonic 80A; Inconel X-750; Hastelloy X; Incoloy 901; D-979; Waspalloy; Nimonic 90; Nimonic 100; Inconel 700; Udimet 500; M-252; Rene' 41; Hastelloy B; Hastelloy N; Hastelloy C; thermal conductivity; 4.2 K

Monel 400; Monel Alloy K-500; Inconel 600; Nimonic 75; Nimonic 80A; Inconel X-750; Alloy 713C; Hastelloy F; Hastelloy X; Incoloy 901; D-979; Waspalloy; Nimonic 90; Nimonic 100; Inconel 700; Udimet 500; M-252; Rene' 41; Hastelloy B; Hastelloy N; Hastelloy C; thermal expansion; 4.2 K

Inconel 600; Nimonic 80A; Inconel X-750; Incoloy 901; D-979; Nimonic 90; Udimet 500; M-252, Rene' 41; modulus of elasticity; 4.2 K

Monel 400; Monel Alloy K-500; Inconel 600; Nimonic 80A; Inconel X-750; D-979; M-252; Rene' 41; Poisson's Ratio; 4.2 K

Monel Alloy K-500; Inconel 600; Inconel X-750; Hastelloy B; Hastelloy C; magnetic permeability; 4.2 K

Inconel X-750; Udimet 500; Udimet 700; electrical resistivity; 4.2 K

110. Lenhart, H. B., "Cryogenic Research - Tensile Properties of 2219-T87 Aluminum Alloy Plate at Room and Cryogenic Temperatures", Test Progress Report SLML-60-473, Boeing Company (December 6, 1960).

2219-T87; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; -450 F

111. Lismer, R. E., "The Properties of Some Metals and Alloys at Low Temperatures", Journal of the Institute of Metals, 89, 145-161 (1960/1961).

Copper; Cu-40Zn (brass); Cu-10Ni (Cupro-nickel); Cu-20Ni (Cupro-nickel); Cu-30Ni (Cupro-nickel); Cu-5Ni-1Fe (Kunifer 5); Cu-20Ni-1Fe (Kunifer 20); Cu-12Mn-7Al-2Ni-2Fe (Superston 40); Monel 400; Inconel 600; 18/8 stainless; 3Ni steel; 9Ni steel; tensile yield strength; elongation; reduction in area; impact properties; notch tensile strength; -196 C

112. Lucas, W. R., and Cataldo, C. E., "Some Low-Temperature Properties of Aluminum-Alloy Weldments", ASTM Special Technical Publication No. 287 (June 1960).

5052; 5086; 5456; 2014-T3; 2014-T6; weld properties; ultimate tensile strength; elongation; -320 F

113. Martin, D. L., "The Specific Heat of Copper From 20 to 300 K", Canadian Journal of Physics, 38 (1), 17-24 (1960).

Copper; specific heat; 20 K

114. Martin, D. L. "The Specific Heat of Annealed and Cold-Worked Copper From 0.4 to 1.5 K", Canadian Journal of Physics, 38, 1390-1391 (1960).

copper; specific heat; 0.4 K

115. McClintock, R. M., and Gibbons, H. P., "Mechanical Properties of Structural Materials at Low Temperatures. A Compilation From the Literature", National Bureau of Standards Monograph 13 (June 1, 1960).

Aluminum alloys; copper alloys; nickel alloys; titanium alloys; magnesium alloys; stainless steels; engineering steels; mechanical properties; 4 K

116. McConnell, J. H., "Austenitic Stainless Steels: Thousands of Tons in -300 to -425 F Service", Chemical Engineering, 67 (14), 125-128 (July 11, 1960).

AISI 302; AISI 304; AISI 304L; AISI 310; AISI 347; modulus of elasticity; impact properties; weld properties; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -425 F

117. Mikesell, R. P. and Reed, R. P., "The Impact Testing of Various Alloys at Low Temperatures", Proceedings of the 1957 Cryogenic Engineering Conference, 316-324 (1960).

OFHC copper; copper alloys; aluminum alloys; nickel alloys; impact properties; 24 K

118. Olleman, R. D., and Wolfer, G. C., "The Tensile and Impact Properties of Plate and Welds of Aluminum Alloy 5083-H113 Between 75 and -320 F", Advances in Cryogenic Engineering, Volume 5, Plenum Press, Inc., New York (1960), pp 430-438.

5083-H113; impact properties; tensile properties; -320 F

119. Ottlyk, A. A., "Cryogenic Tensile Properties of .040 Gage 301XH Stainless Steel", Test Progress Report, SLML-60-414, EWA 59202, Boeing Company (October 28, 1960).

AISI 301; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; -450 F

120. Powell, R. L., Hall, W. J., and Roder, H. M., "Low-Temperature Transport Properties of Commercial Metals and Alloys. II. Aluminums", Journal of Applied Physics, 31 (3), 496-503 (March 1960).

1100 aluminum; 3003; 2024-T4; 5052-0; 5083-0; 5086-0; 5154-0; 6063-T5; thermal conductivity; electrical resistivity; 4 K

121. Powell, R. L., Rogers, W. M., and Roder, H. M., "Thermal Conductivities of Copper and Copper Alloys", Advances in Cryogenic Engineering, Volume 2, Plenum Press, Inc., New York (1960), pp 166-171.

Unalloyed copper; electrolytic tough pitch copper; OFHC copper; Cu-32Zn-3Pb (brass); Cu-3Si-1Mn (silicon bronze); thermal conductivity; 4 K

122. Reed, R. P., Mikesell, R. P., and Greeson, R. L., "Some Mechanical Properties of Magnesium Alloys at Low Temperatures", Advances in Cryogenic Engineering, Volume 5, Plenum Press, Inc., New York (1960), pp 397-405.

AZ31B-0; ZE10A-H11; ZE10A-H10; HM21A-T8; HK31A-0; KH31A-T6; impact properties; ultimate tensile strength; tensile yield strength; elongation; 20 K

123. Rice, L. P., Campbell, J. E., and Simmons, W. F., "The Evaluation of the Effects of Very Low Temperatures on the Properties of Aircraft and Missile Metals", WADD-TR-60-254, Battelle Memorial Institute, Contract AF 33(616)-6345 (June 1960).

Ti-6Al-4V; Ti-4Al-3Mo-1V; Ti-16V-2.5Al; Ti-13V-11Cr-3Al; 17-7PH; 15-7PH; Vacsojet 1000; AISI 301; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; notch tensile strength; -253 C

124. Schwartzberg, F., Agricola, K., and Hauser, R., "Properties of Missile Materials at Cryogenic Temperatures", Technical Report, Martin Company (May 1960).

Aluminum alloys; 1100 aluminum; 6061-0; 6061-T6; 2014-T6; 2024-T3; 7075-T6; 7079-T6; 5052-0; 5052-H34; 355-T6; AISI 301; AISI 304L; AISI 302; AISI 303; AISI 310; AISI 316; 17-7PH; AM350; Ti-5Al-2.5Sn; Ti-8Mn; Ti-6Al-4V; magnesium alloys; HM31A-F; HK31A-0; HK31A-T6; HM21A-T8; AZ31B-0; ZE10A-H11; ZK60A-T5; OFHC copper; Monel 400; Inconel X-750; Rene' 41; AISI 4340; AISI 9310; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

125. Trepus, G. E., Roper, R. S., and Hickman, W. R., "Design Data for O-Rings and Similar Elastic Seals", WADC Technical Report 56-272, Part V, Boeing Airplane Company, Contract AF 33(616)-5722 (March 1960).

Teflon; Kel-F; thermal expansion; compressive strength; -425 F

126. Warfield, R. W., and Petree, M. C., "Thermodynamic Properties of Polystyrene and Styrene", NAVWEPS Report 7352, U.S. Naval Ordnance Laboratory (September 21, 1960).

Polystyrene; polyethylene; specific heat; 0 K

127. Watson, J. F., and Christian, J. L., "The Effect of Cryogenic Temperatures on the Mechanical Properties of High Strength Sheet Alloys (Nonferrous Alloys)", Technical Report ERR-AN-002, Convair-Astronautics/General Dynamics (April 13, 1960).

Titanium; Monel alloy K-500; A-286; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

128. Watson, J. F., and Christian, J. L., "Low-Temperature Properties of Cold-Rolled AISI Types 301, 302, 304ELC, and 310 Stainless Steel Sheet", ASTM Special Technical Publication No. 287, 170-195 (June 30, 1960).

AISI 301; AISI 302; AISI 304; AISI 310; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

129. Watson, J. F., and Christian, J. L., "Mechanical Properties of High-Strength 301 Stainless Steel Sheet at 70, -320, and -423 F in the Base Metal and Welded Joint Configuration", ASTM Special Technical Publication No. 287, 136-149 (June 30, 1960).

AISI 301; ultimate tensile strength; elongation; notch tensile strength; weld properties; -423 F

130. Watson, J. F., and Christian, J. L., "The Effect of Cryogenic Temperatures on the Mechanical Properties of High Strength Sheet Alloys (Cold Worked Austenitic Stainless Steels)", Technical Report ERR-AN-003, Convair-Astronautics/General Dynamics (May 16, 1960).

AISI 301; AISI 302; AISI 304; AISI 310; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

131. Watson, J. F., Christian, J. L., and Hertz, J., "Selection of Materials For Cryogenic Applications in Missiles and Aerospace Vehicles", Technical Report GDA-MRG-132-1, General Dynamics (February 1960).

AISI 301; AISI 304; AISI 302; AISI 310; AM 355; A-286; 5052-H38; 5086-H34; 5154-H38; 5083; 5456; 2014-T6; 2024-T3; 2024-T4; 6061-T4; 6061-T6; 7075; 7079; 7178; Ti-6Al-4V; Ti-5Al-2.5Sn; Ti-6Al-4Zr-1V; Ti-7Al-12Zr; Monel alloy K-500; L-605; Hastelloy B; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

132. Wessel, E. T., "The Performance Characteristics of Low Temperature Tension Testing Apparatus and Its Application in Industry", Advances in Cryogenic Engineering, Volume 2, 1956 Conference, Plenum Press, Inc., New York (1960), pp 126-135.

AISI 4340; zirconium; nickel; AISI 3335; niobium; ultimate tensile strength; tensile yield strength; elongation; reduction in area; 4.2 K

133. White, G. K., and Woods, S. B., "Conductivity of Metallic Cryogenic Materials", Advances in Cryogenic Engineering, Volume 2, Plenum Press, Inc., New York (1960), pp 120-124.

Inconel 600; Cu-5Zn; Cu-30Zn; rhenium; thermal conductivity; 4 K

1961

134. "Final Results From Operation Cryogenics", International Nickel Company, Inc. (1961).

9Ni steel; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; -320 F

135. "New Cryogenic Strength Data for Plastics", Materials in Design Engineering, 54 (3), 155 (September 1961).

Polytetrafluoroethylene (Teflon); flexural properties; compressive properties; -320 F

136. Achbach, W. P., and Favor, R. J., "Design Properties as Affected by Cryogenic Temperatures (Ti-6Al-4V, AISI 4340, and 7079-T6 Alloys)", DMIC Memorandum 81 (January 24, 1961).

Ti-6Al-4V; AISI 4340; 7079-T6; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 K

137. Achbach, W. P., and Favor, R. J., "Design Properties as Affected by Cryogenic Temperatures (Ti-6Al-4V, AISI 4340, and 7079-T6 Alloys)", Technical Report M-81, Battelle Memorial Institute, Contract AF 33(616)-6410 (January 1961).

Ti-6Al-4V; AISI 4340; 7079-T6; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 K

138. Alers, G. A., and Thompson, D. O., "Dislocation Contributions to the Modulus and Damping in Copper at Megacycle Frequencies", Journal of Applied Physics, 32 (2), 283-293 (February 1961).

Copper; modulus of elasticity; 4.2 K

139. Alper, R. H., "Cryogenic Stretch Forming of Rocker Motor Cases", Final Report, Arde-Portland, Inc., Navy Bureay of Weapons Contract NOw-60-023-c (May 15, 1961).

AISI 301; ultimate tensile strength; elongation; -320 F

140. Calverly, A., Mendelssohn, K., and Rowell, P. M., "Some Thermal and Magnetic Properties of Tantalum, Niobium, and Vanadium at Helium Temperatures", Cryogenics, 2 (1), 26-33 (September 1961).

Niobium; tantalum; vanadium; thermal properties; magnetic properties; -423 F

141. Campbell, J. E., "Review of Recent Developments in the Evaluation of Special Metal Properties", Technical Report M-128, Battelle Memorial Institute (September 1961).

Ti-6Al-4V; Ti-5Al-2.5Sn; Ti-13V-11Cr-3Al; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

142. Campbell, J. E., "Review of Recent Developments in the Evaluation of Special Metal Properties", Technical Report M-112, Battelle Memorial Institute (June 1961).

Aluminum alloys; 2014-T6; 6061-T6; 5456-H24; Ti-5Al-2.5Sn; AISI 301; AISI 310; ultimate tensile strength; tensile yield strength; elongation; weld properties; notch tensile strength; -423 F

143. Campbell, J. E., "Review of Recent Developments in the Evaluation of Special Metal Properties", Technical Report M94M-94, Battelle Memorial Institute (March 1961).

AISI 301; AISI 304L; ultimate tensile strength; tensile strength; elongation; reduction in area; fracture mechanics; -423 F

144. Campbell, J. E., "Review of Current Data on the Tensile Properties of Metals at Very Low Temperatures", DMIC-148, Battelle Memorial Institute, Contract AF 33(616)-7747 (February 1961).

6061-T4; 6061-T6; 2014-T6; 2219-T62; Inconel X-750; Monel alloy K-500; AISI 301; AISI 304; AISI 310; A-286; Ti-6Al-V4; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

145. Campbell, J. E., "Review of Current Data on the Tensile Properties of Metals at Very Low Temperatures", DMIC Report 148, Battelle Memorial Institute (February 14, 1961).

6061-T4; 6061-T6; 2014-T6; 2219-T62; AISI 301; AISI 310; AISI 304; A-286; Ti-6Al-4V; Ti-5Al-2.5Sn; Inconel X-750; Monel alloy K-500; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

146. Chafey, J. E., "Compilation of Materials Research Data", Technical Report AE-62-0138-2, General Dynamics, Contract AF 33(616)-7984 (September 1961).

AM 350; AM 355; A-286; Inconel X-750; Ti-75A; Ti-8Al-1Mo-1V; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

147. Christensen, R. J., and Denke, P. H., "Crack Strength and Crack Propagation Characteristics of High Strength Metals", Technical Report TR-61-207, Douglas Aircraft Company, Inc., Contract AF 33(616)-7444 (May 1961).

15-7PH; AM 335; AISI 4340; Rene' 41; Ti-13V-11Cr-3Al; fatigue crack propagation; -340 F

148. Christian, J. L., and Watson, J. F., "Properties of 7000 Series Aluminum Alloys at Cryogenic Temperatures", Proceedings of the 1960 Cryogenic Engineering Conference, 604-621 (1961).

2014; 2024; 2219; 5052; 5083; 5086; 5154; 5456; 6061; 7075; 7079; 7178; 7275; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; modulus of elasticity; fracture properties; -423 F

149. Christian, J. L., "Determination of the Effect of Oxygen Content on the Mechanical Properties of Titanium - 5Al-2.5Sn Alloy at Room and Cryogenic Temperatures", Technical Report MRG-266, General Dynamics (October 20, 1961).

Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; toughness; -423 F

150. Corruccini, R. J., and Gniewek, J. J., "Thermal Expansion of Technical Solids at Low Temperatures", National Bureau of Standards Monograph 29 (May 19, 1961).

Aluminum; copper; brass; Inconel X-750; Invar; Monel alloy X-500; AISI 301; AISI 310; AISI 316; thermal expansion; 4 K

151. Day, D. L., and Kessler, H. D., "Titanium Sheet Rolling Program for Ti-8Al-1Mo-1V, Ti-5Al-5Sn-5Zr, and Ti-7Al-12Zr", Technical Report NOAS59-6227, Titanium Metals Corporation of America (December 1961).

Ti-8Al-1Mo-1V; Ti-5Al-5Sn-5Zr; Ti-7Al-12Zr; tensile yield strength; notch tensile strength; modulus of elasticity; -320 F

152. DeSisto, T. S., and Carr, L. C., "Low Temperature Mechanical Properties of 300 Series Stainless Steel and Titanium", Proceedings of the 1960 Cryogenic Engineering Conference, 577-586 (1961).

AISI 302; AISI 303; AISI 304; AISI 316; AISI 347; Ti-55A; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -452 F

153. DeSisto, T. S., and Carr, F. L., "Low Temperature Mechanical Properties of 300 Series Stainless Steel and Titanium", Technical Report WAL TR-323.4/1, Watertown Arsenal (December 1961).

AISI 302; AISI 303; AISI 304; AISI 316; AISI 347; Ti-55A; ultimate tensile strength; elongation; reduction in area; true stress; true strain; -452 F

154. Domenicali, C. A., and Christenson, E. L., "Effects of Transition Metal Solutes on the Electrical Resistivity of Copper and Gold Between 4 and 1200 K", Journal of Applied Physics, 32 (11), 2450-2456 (November 1961).

Copper; Cu-2Ni; Cu-5Ni; Cu-10Ni; gold; gold alloys; electrical resistivity; 4 K

155. Eldridge, E. A., and Deem, H. W., "Report on Physical Properties of Metals and Alloys From Cryogenic to Elevated Temperatures", ASTM Special Technical Publication No. 296 (April 1961).

Aluminum; cobalt; iron; magnesium; molybdenum; nickel; density; thermal expansion; specific heat; electrical resistivity; -457 F

156. Espey, G. B., Jones, M. H., and Brown, W. F., Jr., "Factors Influencing Fracture Toughness of Sheet Alloys for Use in Lightweight Cryogenic Tankage", ASTM Special Technical Publication No. 302, 140-171 (June 1961).

AISI 301; AISI 310; Inconel X-750; Ti-5Al-2.5Sn; notch tensile strength; fracture toughness; -423 F

157. Fan, H. Y., "Semiconductor Research", Technical Report, Purdue Research Foundation (March 1961).

Copper alloys; zinc alloys; germanium alloys; magnesium alloys; thermal conductivity; electrical properties; magnetic properties; -320 F

158. Favor, R. J., and Gideon, D. N., "Investigation of Fatigue Behavior of Certain Alloys in the Temperature Range: Room Temperature to -423 F", ASD-TR-61-132, Battelle Memorial Institute, Contract AF 33(616)-6888 (June 1961).

1100 aluminum; 2024; 6061; 7075; Cu-1.9Be (Berylco 25); Cu-30Zn (brass); AISI 302; AISI 304; AISI 347; 17-7PH; 9Ni steel; Monel alloy K-500; Ti-6Al-4V; Inconel 600; Inconel X-750; Ni-Span C; fatigue properties; -423 F

159. Feltham, P., "Creep and Stress Relaxation in Alpha-Brass at Low Temperatures", Philosophical Magazine, 6, 259-270 (1961).

Cu-35Zn (brass); creep properties; stress relaxation; 77 K

160. Guntner, C. J., and Reed, R. P., "Mechanical Properties of Four Austenitic Stainless Steels at Temperatures Between 300 and 20 K", Proceedings of the 1960 Cryogenic Engineering Conference, 565-576 (1961).

17Cr steel; AM350; AISI 202; AISI 304; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; 20 K

161. Hanson, M. P., "Smooth and Sharp-Notch Tensile Properties of Cold-Reduced AISI 301 and 304L Stainless Steel Sheet at 75, -320, and -423 F", NASA TN D-592, Lewis Research Center (February 1961).

AISI 301; AISI 304L; 6061-T6; 2219-T62; 2014-T6; 5456-H321; 7079-T6; 7075-T6; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-13V-11Cr-3Al; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

162. Hertz, J., "Cryogenic Adhesive Evaluation Study", Technical Report ERR-AN-032, General Dynamics/Convair-Astronautics, Contract AF 33(616)-7984 (January 25, 1961).

Electrolytic tough pitch copper; Ti-5Al-2.5Sn; AISI 301; AISI 321; AISI 52100; 2024-T3; Teflon; bond shear strength; lap shear strength; ultimate tensile strength; -320 F

163. Huzan, E., Abbiss, C. P., and Jones, G. O., "Thermal Expansion of Aluminum at Low Temperatures", Philosophical Magazine, 6, 277-285 (1961).

Aluminum; thermal expansion; 15 K

164. Javitz, A. E., "Cryogenics: Environment, Phenomena, Applications", Electro-technology, 68 (5), 63-75 (September-November 1961).

State-of-the-Art; Teflon; Kel-F; polyethylene; nylon; Mylar; ultimate tensile strength; compressive yield strength; modulus of elasticity; 4 K

Teflon; polystyrene; copper; nickel; aluminum; magnesium; titanium; AISI 1020; AISI 304; thermal expansion; 20 K

1100 aluminum; 6063-T5; 3003; 5052; 5154; 2024-T4; thermal conductivity; 4 K

1100 aluminum; 2024-T4; 5154; 5052; 6063-T5; Cu-40Ni (Constantan); Cu-25Zn-14Ni (nickel-silver); electrical resistivity; -328 F

165. Kaufman, J. G., and Johnson, E. W., "New Data on Aluminum Alloys for Cryogenic Applications", Proceedings of the 1960 Cryogenic Engineering Conference, 637-649 (1961).

1100-H112; 3003-H112; 5052-H112; 5154-H112; 5454-H32; 5086-H32; 5083-H113; 5456-H321; 6061-T6; ultimate tensile strength; notch tensile strength; tensile yield strength; elongation; reduction in area; weld properties; -320 F

166. King, E. J., "Investigation of Aluminum Alloy 6061-T4, T6 Welded and Unwelded", Technical Report BLR-61-40-M, Bell Aerosystems Company, Contract AF 33(657)-855 (December 1961).

6061-T4; 6061-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -320 F

167. Lutes, O. S., and Schmit, J. L., "Magnetic Remanence in Dilute Alloys", Technical Report, Honeywell Research Center, Contract NONR-273200 (October 1961).

Copper alloys; manganese alloys; chromium alloys; gold alloys; magnetic properties; -320 F

169. Markovich, R., and Schwartzberg, F., "Testing Techniques and Evaluation of Materials For Use at Liquid Hydrogen Temperature", Technical Report R-61-4, The Martin Company (February 1961).

2014-T6; 6061-T6; 5456-H24; 2219-T81; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; weld properties; -423 F

170. Miller, P. C., "Low Temperature Mechanical Properties of Several Aluminum Alloys and Their Weldments", Technical Report MTP-S&M-M-61-16, NASA George C. Marshall Space Flight Center (October 2, 1961).

7079-T6; 5052-H32; 5086-H34; 5456-H343; 2014-T6; ultimate tensile strength; tensile yield strength; elongation; weld properties; -450 F

171. Mishler, H. W., and Nichols, H. J., "An Investigation of the Low-Temperature Impact Properties of Stainless Steel Weldments", Welding Journal, Welding Research Supplement, 40, 564s-568s (December 1961).

AISI 304; AISI 304L; AISI 310; AISI 308; AISI 308L; impact properties; weld properties; -320 F

172. Mowers, R., "A Simplified Determination of Crystallinity of Fluoroplastics and the Prediction of Their Behavior at Cryogenic Temperatures", Advances in Cryogenic Engineering, 6 (1961), pp 627-636.

Kel-F; Teflon; ultimate tensile strength; tensile yield strength; compressive yield strength; flexure strength; elongation; impact properties; -320 F

173. Peckner, D., and Riley, M. W., "The Role of Materials in Cryogenics", Materials in Design Engineering, 54 (1), 107-118 (July 1961).

Aluminum; magnesium; molybdenum; AISI 4340; AISI 301; titanium; Ti-6Al-4V; Ti-7Mn; modulus of elasticity; bulk modulus; shear modulus; -452 F

1100-H14; 2014-T6; 2024-T3; 2219-T62; 5052-0; 5052-H34; 6061-0; 6061-T6; 7075-T6; 7079-T6; 7178-T6; 355-T6; ultimate tensile strength; tensile yield strength; elongation; -423 F

174. Salinger, G. L., and Wheatley, "Magnetic Susceptibility of Materials Commonly Used in the Construction of Cryogenic Apparatus", Review of Scientific Instruments, 32 (7), 872-874 (July 1961).

AISI 303; AISI 304; AISI 316; AISI 321; AISI 347; Cu-30Ni (Cupro-nickel); Inconel 600; magnetic susceptibility; 1.6 K

175. Schwartzberg, F. R., and Keys, R. D., "Mechanical Properties of 2000 Series Aluminum Alloys at Cryogenic Temperatures", Technical Report R-61-32, The Martin Company (October 1961).

2014-T6; 2219-T81; 2618-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

176. Schwartzberg, F. R., and Keys, R. D., "Mechanical Properties of an Alpha Titanium Alloy at Cryogenic Temperatures", Technical Report R-61-45, The Martin Company (December 1961).

Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -320 F

177. Warfield, R. W., and Petree, M. C., "Thermodynamic Properties of Polyethylene", Technical Report NOLTR 61-92, U.S. Naval Ordnance Laboratory (October 1961).

Polyethylene; polytetrafluoroethylene; specific heat; 0 K

178. Warfield, R. W., and Petree, M. C., "Electrical Resistivity of Polymers", SPE Transactions, 1 (2), 80-85 (April 1961).

Polyethylene; polystyrene; polytrifluorochloroethylene; polymethylmethacrylate; electrical resistivity; 2.4 K

179. Watson, J. F., Christian, J. L., Tanalski, T. T., and Hurlich A., "Correlation of Notched: Unnotched Tensile Ratios With Tensile Fatigue Properties of Complex Welded Joints in High-Strength 300 Series Stainless Steels at Cryogenic Temperatures", ASTM Special Technical Publication No. 302, 129-139 (June 1961).

AISI 301; AISI 301N; AISI 310; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; fatigue properties; -423 F

180. Watson, J. F., Christian, J. L., and Hertz, J., "Cryogenics: Selection Data For Structural Materials", Electro-Technology, 68 (5), 76-84 (September-November 1961).

AISI 301; AISI 304; AISI 310; AISI 302; 5052-H38; 5086-H34; 6061-T6; Ti-5Al-2.5Sn; Monel alloy K-500; L-605; Hastelloy B; AM 355; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

181. Watson, J. F., and Christian, J. L., "Low-Temperature Properties of K-Monel, Inconel-X, Rene 41, Haynes 25, and Hastelloy B Sheet Alloys", Paper presented at the Winter Annual Meeting of the American Society of Mechanical Engineers, New York, New York (November 26-December 1, 1961).

Monel alloy K-500; Inconel X-750; Rene 41; L-605; Hastelloy B; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

182. White, G. K., "Thermal Expansion at Low Temperatures. II. Electronic Component in Metals", Philosophical Magazine, 6 (66), 815-818 (1961).

Aluminum; beryllium; chromium; copper; iron; palladium; thermal expansion; 1.5 K

183. White, G. K., "Measurement of Thermal Expansion at Low Temperatures", Cryogenics, 1 (3), 151-158 (March 1961).

Copper; beryllium; thermal expansion; 4.2 K

184. Zenner, G. H., "What Metal Shall I Use for Fabrication of Cryogenic Vessels and Equipment?", Metal Progress, 80 (4), 110-115, 154, and 156 (October 1961).

3Ni steel; 9Ni steel; AISI 301; AISI 303; AISI 304; AISI 305; AISI 309; AISI 310; AISI 316; AISI 321; AISI 347; copper; Cu-3Si (copper-silicon); Cu-40Zn (Muntz metal); 3003; 5052; 5083; 5086; 5154; 5456; Monel 400; Invar; Ti-6Al-4V; ultimate tensile strength; impact properties; weld properties; thermal conductivity; thermal expansion; -423 F

1962

185. "Determination of Design Data for Heat Treated Titanium Alloy Sheet. Volume 3. Tables of Data Collected", Technical Report ASD-TDR-62-335 V3, Lockheed Aircraft Corporation, contract AF 33(616)-6346 (December 1962).

Ti-13V-11Cr-3Al; Ti-6Al-4V; Ti-16V-2.5Al; Ti-4Al-3Mo-1V; ultimate tensile strength; tensile yield strength; elongation; compressive properties; bearing properties; shear properties; weld properties; creep properties; thermal expansion; -320 F

186. "Low and Room Temperature Tensile Properties of 2219-T87 Aluminum Alloy", Technical Report 9068, McDonnell Aircraft Corporation, Contract AF 33(657)-7749 (October 1962).

2219-T87; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

187. "Titanium for Liquid Hydrogen Applications. Investigation of the Influence of Chemistry on Low Temperature Behavior of Titanium Alloys", Data Sheets EFE, Titanium Metals Corporation of America (May 1962).

Ti-5Al-2.5Sn; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongaton; notch tensile sterngth; -423 F

188. Arp, V., Wilson, J. H., Winrich, L., and Sikora, P., "Thermal Expansion of Some Engineering Materials From 20 to 293 K", Cryogenics, 2 (4), 1-6 (June 1962).

1100 aluminum; 356; 2020; 2024; 6061; 7075; Elgiloy; Stellite 3; Stellite 25; Cu-1.8Be (Berylco 25); Cu-30Zn (brass); 17-4PH; 17-7PH; A-286; AISI 302; AISI 303; AISI 304L; 9Ni steel; Ni-Span C; Kromarc 55; AISI 310; AISI 321; AISI 347; AISI 416; 17Cr steel; AISI 1075; Inconel 600; Inconel X-750; nickel; Rene 41; Ti-5Al-2.5Sn; Ti-13V-11Cr-3Al; Ti-6Al-4V; graphite; thermal expansion; 20 K

189. Bergstedt, P., "Compilation of Materials Research Data", Technical Report AE-62-0138-3, General Dynamics, Contract AF 33(616)-7984 (March 1962).

Titanium; titanium alloys; aluminum alloys; AISI 301; Rene 41; fatigue properties; -320 F

190. Bringer, R. P., "Fluorocarbons, CTFE Fluorocarbons", Machine Design, 34 (22), 84-86 (September 20, 1962).

Polytrifluoroethylene (Kel-F); ultimate tensile strength; tensile yield strength; elongation; compressive yield strength; flexural strength; shear ultimate strength; impact properties; hardness; modulus of elasticity; electrical resistivity; dielectric properties; 77 K

191. Cataldo, C. E., "Weldability Studies of 5456-H343 and 2219-T87 Aluminum Alloy Plates", Internal Note IN-P&VE-M-62-2, NASA George C. Marshall Space Flight Center (April 2, 1962).

5456-H343; 2219-T87; weld properties; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

192. Christian, J. L., and Watson, J. F., "Mechanical Properties of Several 5000-Series Aluminum Alloys at Cryogenic Temperatures", Proceedings of the 1961 Cryogenic Engineering Conference, 490-499 (1962).

5052-H38; 5083-H38; 5086-H34; 5086-H38; 5154-H38; 5456-H343; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

193. Christian, J. L., "Physical and Mechanical Properties of Pressure Vessel Materials for Application in a Cryogenic Environment", ASD-TDR-62-258, General Dynamics, Contract AF 33 (616)-7719 (March 1962).

AISI 301; AISI 304L; AISI 310; AM 355; 2014-T6; 5052-H38; 5456-H343; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; hardness; notch tensile strength; fracture toughness; weld properties; -423 F

194. Christian, J. L., Gruner, J. D., and Girton, L. D., "The Effects of Cold Rolling on the Mechanical Properties of Type 310 Stainless Steel at Room and Cryogenic Temperatures", Technical Report AR-592-1-365, NASA CR-54614, Astronautics/General Dynamics (November 27, 1962).

AISI 310; ultimate tensile strength; tensile yield strength; elongation; -423 F

195. Christian, J. L., "Mechanical Properties of Air Melted and Consutrode Melted Type 302 Stainless Steel at Room and Cryogenic Temperatures", Technical Report MRG-307, General Dynamics, Contract AF 33(616)-7984 (April 4, 1962).

AISI 302; ultimate tensile strength; tensile yield strength; elongation; -423 F

196. Christian, J. L., "Mechanical Properties of High-Strength Sheet Materials at Cryogenic Temperatures", Technical Report ERR AN 255, Astronautics/General Dynamics (November 28, 1962).

2024-T4; 7079-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

197. Christian, J. L., "Mechanical Properties of Hastelloy Sheet Alloy R-235 at Cryogenic Temperatures", Technical Report MRG-300, NASA CR-54598, Convair/General Dynamics (March 19, 1962).

R-235; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

198. Christian, J. L., "The Effects of Cold Rolling on the Mechanical Properties of Type 310 Stainless Steel at Room and Cryogenic Temperatures", Technical Report AR-592-1-329, General Dynamics (July 24, 1962).

AISI 310; ultimate tensile strength; tensile yield strength; elongation; -423 F

199. Curtis, A. J., "Dielectric Properties of Solid Polymers", SPE Transactions, 2 (1), 82-85 (January 1962).

Polystyrene; dielectric properties; -178 C

200. DeMoney, F. W., and Wolfer, G. C., "Tensile and Impact Properties of 7075-T6 Plate, Hand Forgings, and Tensile Properties of Plate MIG Weldments Between 75 and -320 F", Proceedings of the 1961 Cryogenic Engineering Conference, 466-477 (1962).

7075-T6; 7079-T6; impact properties; weld properties; ultimate tensile strength; tensile yield strength; elongation; -320 F

201. DeSisto, T. S., "Low Temperature Charpy True Stress-Strain and Notched Tensile Properties of Base Metal and Weld Deposits of AISI Type 301, 310, 316 and 347 Stainless Steels", Paper presented at the Annual ASTM Meeting, New York (June 1962).

AISI 301; AISI 310; AISI 316; AISI 347; impact properties; notch tensile strength; weld properties; -269 C

202. Fluornoy, R. W., "Aluminum Alloys For Cryogenic Equipment", Light Metal Age, 19, 10-12 and 28 (April 1962).

1100 aluminum; 3003; 3004; 5050; 5052; 5083; 5086; 5154; 5456; 6061; 6063; ultimate tensile strength; tensile yield strength; elongation; -320 F

203. Fuller, P. D., and McLagan, J. N., "Storage and Transfer of Cryogenic Fluids", Applied Cryogenic Engineering, Chapter 9, 249, John Wiley & Sons, Inc., New York (1962).

Teflon, Kel-F; 2024; 6061; copper; AISI 304; AISI 316; AISI 303; AISI 330; Monel 400; Inconel 600; thermal expansion; -423 F

204. Gideon, D. N., Favor, R. J., Koppenhafer, A., Grover, H. J., and McClure, M., "Investigation of Notch Fatigue Behavior of Certain Alloys in the Temperature Range of Room Temperature to -423 F", ASD-TDR-62-351, Battelle Memorial Institute, WPAFB Contract AF 33(616)-6888 (August 1962).

Ti-6Al-4V; 9Ni steel; AISI 301; AISI 347; nickel; Monel alloy K-500; Inconel 600; Cu-1.9Be (Berylco 25); Cu-30Zn (brass); Ni-Span C; AISI 1075; 17-7PH; Inconel X-750; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; density; notch properties; fatigue properties; -423 F

205. Gideon, D. N., Favor, R. J., Grover, H. J., and McClure, G. M., "The Fatigue Behavior of Certain Alloys in the Temperature Range From Room Temperature to -423 F", Proceedings of the 1961 Cryogenic Engineering Conference, 503-508 (1962).

Ti-6Al-4V; 9Ni steel; AISI 301; AISI 347; nickel; Monel alloy K-500; Inconel 600; Berylco 25; Cu-30Zn; Ni-Span C; AISI 1075; 17-7PH; Inconel X-750; fatigue properties; -423 F

206. Goodman, B. B., "The Thermodynamic Properties of Superconducting V_3Ga", Physics Letters, 1 (6), 215-217 (June 15, 1962).

V_3Ga; superconductivity; magnetization; specific heat; 0 K

207. Guntner, C. J., and Reed, R. P., "Martensitic Transformation Products and Mechanical Properties of Austenitic Stainless Steels at Low Temperatures", Proceedings of the 1961 Cryogenic Engineering Conference, 500-502 (1962).

AISI 304L; ultimate tensile strength; tensile yield strength; notch tensile strength; 20 K

208. Guntner, C. J., and Reed, R. P., "The Effect of Experimental Variables Including the Martensitic Transformation on the Low-Temperature Mechanical Properties of Austenitic Stainless Steels", Transactions of the ASM, 55, 399-419 (September 1962).

AISI 304; AISI 304L; AISI 310; AISI 202; 17Cr steel; AM 350; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; 4 K

209. Hanson, M. P., and Richards, H. T., "Smooth and Sharp-Notch Property Variations for Several Heats of Ti-6Al-4V Sheet at Room and Cryogenic Temperatures", NASA Technical Note D-1282 (May 1962).

Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

210. Hickey, C. F., "Mechanical Properties of Titanium and Aluminum Alloys at Cryogenic Temperatures", Technical Report WAL TR 340.2/1, Watertown Arsenal (March 1962).

Ti-7Al-4Mo; Ti-7Al-3Mo; Ti-6Al-4V; Ti-4Al-3Mo-1V; Ti-16V-2.5Al; Ti-13V-11Cr-3Al; Ti-7Al-4V; Ti-6.5Al-3Mo-1V; Ti-5Al-1.5Fe-1.4Cr-1.2Mo; 6061-T6; 7075-T6; 2024-T4; 2017-T4; 2014-T6; 5086-H34; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; -452 F

211. Hickey, C. F., Jr., "Mechanical Properties of Titanium and Aluminum Alloys at Cryogenic Temperatures", Preprint of paper presented at the sixty-fifth Annual ASTM Meeting (June 25-29, 1962).

Ti-7Al-4Mo; Ti-7Al-3Mo; Ti-6Al-4V; Ti-4Al-3Mo-1V; Ti-16V-2.5Al; Ti-13V-11Cr-3Al; Ti-7Al-4V; Ti-6.5Al-3Mo-1V; Ti-5Al-1.5Fe-1Cr-1Mo; 6061-T6; 7075-T6; 2024-T4; 2017-T4; 2014-T6; 5086-H34; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; -452 F

212. Hilsen, R. R., Yen, C. S., and Whiteson, B. V., "Low Cycle Fatigue of Ti-6Al-4V at -423 F", Paper No. 48 presented at the ASTM Meeting, Los Angeles, California (October 1-5, 1962).

Ti-6Al-4V; low cycle fatigue; -423 F

213. Hurlich, A., "Materials Requirements For Cryogenic Temperature Applications", Paper presented at the ASM 1962 Golden Gate Metals Conference (February 15-17, 1962).

Ti-5Al-2.5Sn; AISI 301; AISI 304L; AISI 310; 2014-T6; 2219-T81; 5052-H38; 7079-T6; Ti-6Al-4V; Ti-8Al-1Mo-1V; Ti-5Al-5Zr-5Sn; Monel alloy K-500; Inconel X-750; Rene 41; Hastelloy B; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

214. Iannelli, A. A., and Rizzitano, F. J., "Charpy Impact Tests of 4340 Steel and 6Al-6V-2Sn Titanium Alloy, Using Standard and Thin Charpy Specimens, Technical Report WAL-TR-112.5/3, Watertown Arsenal (January 1962).

AISI 4340; Ti-6Al-6V-2Sn; impact properties; -320 F

215. Jolley, C. E., "Fluorocarbons, TFE & FEP Resins", Machine Design, 34 (22), 76-83 (September 20, 1962).

Polytetrafluoroethylene (Teflon); tensile yield strength; elongation; flexural modulus; -321 F

216. Kaufman, J. G., and Nelson, F. G., "Cryogenic Temperatures up Fatigue Strengths of Al-Mg Alloys", Space /Aeronautics, 38 (1), 91-93 and 96 (July 1962).

5083-H113; 5086-H32; 5454-H32; 5456-H32; ultimate tensile strength; tensile yield strength; elongation; weld properties; fatigue properties; -320 F

217. King, E. J., "Cryogenic Properties of 2014-T6 and A-286. Phase II", Technical Report BLR-61-35-M, Bell Aerosystems Company, Contract AF 33(657)-8555 (June 1962).

2014-T6; A-286; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; -320 F

218. Kropschot, R. H., "Mechanical Properties of Materials", Applied Cryogenic Engineering, Chapter 3, 44-59, John Wiley & Sons, Inc., New York (1962).

2014-T6; 2024-T3; 5052-H34; 5056-H34; 6061-T6; copper; Muntz metal; Berylco 25; AISI 302; AISI 304; AISI 310; AISI 316; titanium; Ti-5Al-2.5Sn; Ti-6Al-4V; AISI 1010; AISI 1020; ultimate tensile strength; tensile yield strength; elongation; impact properties; 20 K

Mylar; Teflon; Kel-F; polyvinylchloride; nylon; ultimate tensile strength; 77 K

219. Lems, W., "The Change of Young's Modulus of Copper and Silver After Deformation at Low Temperature and Its Recovery", Physica, 28, 445-452 (1962).

Copper; silver; modulus of elasticity; -190 C

220. Lismer, R. E., "Properties of Some Alloys and Weld Metal Deposits at Low Temperatures", Welding and Metal Fabrication, 30 (1), 19-27 (January 1962).

5086; Cu-10Ni (Kunifer 10); Cu-30Ni; Cu-20Ni; AISI 347; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; weld properties; -196 C

221. Lovoy, C. V., "Low Temperature Mechanical Properites of Inconel X and Its Weldments", Internal Note IN-P&VE-M-62-5, NASA George C. Marshall Space Flight Center (July 24, 1962).

Inconel X-750; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

222. Lovoy, C. V., "Low Temperature Mechanical Properties of X-2020-T6 and 2219-T6 Aluminum Sheet Alloys", Internal Note IN-P&VE-M-62-3, NASA George C. Marshall Space Flight Center (May 5, 1962).

2020-T6; 2219-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -450 F

223. Martin, D. L., "A Modified Continuous-Heating Calorimeter For the Temperature Range 15 to 300 K", Canadian Journal of Physics, 40, 1166-1173 (1962).

Copper; specific heat; 15 K

224. Mikesell, R. P., and McClintock, R. M., "A Method of Measuring Shear Modulus From -424 to 70 F", Proceedings of the 1961 Cryogenic Engineering Conference, 509-513 (1962).

Cu-1.8Be (Berylco 25); shear modulus; -424 F

225. Morgan, W. R., "Low Temperature Mechanical Properties of A-286 Alloy and Its Weldments", Technical Report IN-P&VE-M-62-4, NASA George C. Marshall Space Flight Center (1962).

A-286; ultimate tensile strength; tensile yield strength; elongation; weld properties; -423 F

226. Morgan, W. R., "Low Temperature Mechanical Properties of K-Monel Alloy and Its Weldments", Internal Note IN-P&VE-M-62-8, NASA George C. Marshall Flight Space Center (August 28, 1962).

Monel alloy K-500; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

227. Morgan, W. R., "Mechanical Properties of 2219-T87 Alloy Plate at Room and Cryogenic Temperatures", Internal Note IN-P&VE-M-62-9, NASA George C. Marshall Space Flight Center (October 5, 1962).

2219-T87; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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V_3Ga; superconductivity; specific heat; 1.5 K

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Teflon; Kel-F; Mylar; nylon; tensile yield strength; ultimate tensile strength flexural strength; flexural modulus; compressive strength; compressive modulus; impact strength; thermal expansion; -423 F

230. Noonan, J. W., "Materials in the Design of Seals for Extreme Environments", Machine Design, 34 (19), 186-196 (August 16, 1962).

Teflon; Kel-F; ultimate tensile strength; elongation; compressive strength; flexural strength; impact properties; -320 F

231. Rice, L. P., Campbell, J. E., and Simmons, W. F., "Tensile Behavior of Parent Metal and Welded 5000-Series Aluminum-Alloy Plate at Room and Cryogenic Temperatures", Proceedings of the 1961 Cryogenic Engineering Conference, 478-489 (1962).

5454-0; 5454-H34; 5456-0; 5456-H321; 5086-0; 5086-H34; 5083-0; 5083-H113; AISI 304; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; weld properties; -423 F

232. Satterthwaite, C. B., "Thermal Conductivity of Normal and Superconducting Aluminum", Physical Review, 125 (3), 873-876 (February 1, 1962).

Aluminum; thermal conductivity; 0.32 K

233. Sinnott, K. M., "Dynamic Shear Behavior of High Polymers at Low Frequencies", SPE Transactions, 2 (1), 65-73 (January 1962).

Polymethylmethacrylate; polystyrene; polytetrafluoroethylene; shear modulus; 4.2 K

234. Smith, G. W., "Centaur Biaxial Fatigue Tests - Model 55", Technical Report AE62-0866, Astronautics/General Dynamics, Contract AF 18(600)-1775 (October 15, 1962).

AISI 301; ultimate tensile strength; tensile yield strength; elongation; fatigue properties; -423 F

235. Smith, M. B., and Susman, S. E., "Adhesives for Low Temperatures", Machine Design, 34 (25), 188-192 (October 25, 1962).

7075-T6; shear ultimate strength; peel strength; impact properties; compression properties; -320 F

236. Van Elst, H. C., Lubach, B., and Van Den Berg, G. J., "The Magnetization of Some Nickel Alloys in Magnetic Fields Up to 15 kOe Between 0 and 300 K", Physica, 28, 1297-1317 (1962).

Ni-1Cr; Ni-5Cr; Ni-9Cr; Ni-2Mn; Ni-5Mn; Ni-11Mn; Ni-40Cu; Ni-50Cu; Cu-40Ni; Cu-20Ni; magnetization; 0 K

237. Van Itterbeek, A., and Labro, M., "Magnetic Susceptibility of Zinc and Brass Between Room Temperature and 1.2 K", Physica, 28, 721-726 (1962).

Zinc, brass, magnetic susceptibility; 1.2 K

238. Warfield, R. W., and Petree, M. C., "Thermodynamic Properties of Polymethyl Methacrylate and Methyl Methacrylate", NOLTR 62-98, U.S. Naval Ordnance Laboratory (January 17, 1962).

Polystyrene, plexiglas; specific heat; 0 K

1963

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AISI 302; AISI 304; AISI 316; AISI 321; 17-4PH; AISI 410; ultimate tensile strength; tensile yield strength; elongation; impact properties; -320 F

240. "Cryogenic Tensile Properties of Ti-5Al-2.5Sn", Technical Report M-2135, Aerojet-General Corporation (May 14, 1963).

Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; notch tensile strength; -423 F

241. "Materials and Structures Program", Technical Report TDR-169-3240TNI, SSD-TDR-63-76, Aerospace Corporation, Contract AF 04-695-169 (May 1963).

Rene 41; L-605; graphite; creep properties; superconductivity; -320 F

242. "18% Ni Maraging Steel Evaluation For Structural Material", Technical Report 63-247, Aerojet-General Corporation (March 29, 1963).

Maraging (250); ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -420 F

243. Anderson, A. C., Reese, W., and Wheatley, J. C., "Thermal Conductivity of Some Amorphous Dielectric Solids Below 1 K", Review of Scientific Instruments, 34 (12), 1386-1390 (December 1963).

Teflon; nylon; Kel-F; Cu-30Ni; thermal conductivity; 0.7 K

244. Barker, R. E., Jr., "An Approximate Relation Between Elastic Moduli and Thermal Expansivities", Journal of Applied Physics, 34 (1), 107-116 (January 1963).

Silver; aluminum; polyethylene; polystyrene; thermal expansion; specific heat; modulus of elasticity; 5 K

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3003; 5052; 5154; 5085; 5086; 5454; 5356; 5083; 5456; 6061; ultimate tensile strength; tensile yield strength; elongation; reduction in area; weld properties; shear ultimate strength; impact properties; -320 F

Aluminum; magnesium; copper; nickel; manganese; iron; chromium; 18/8 stainless; Monel 400; Teflon; specific heat; -423 F

AISI 304; AISI 1020; Monel 400; Inconel 600; copper; nickel; aluminum; magnesium; zinc; titanium; thermal expansion; -423 F

246. Belton, J. H., Godby, L. L., and Taft, B. L., "Materials for Use at Liquid Hydrogen Temperatures", Paper presented at the Sixty-Third Annual ASTM Meeting, Atlantic City, New Jersey (June 26-July 1, 1963).

2024-T4; 2014-T6; 6061-T6; 7075-T6; 355-T6; Inconel X-750; Waspalloy; Hastelloy X; Inco 702, Cu-2Co-0.5Be (Berylco 10); Cu-1.9Be (Berylco 25); Cu-3Si-2.8Zn-1.5Fe (iron-silicon bronze); Ti-6Al-4V; Ti-5Al-2.5Sn; AISI 9310; A-286; AISI 51410; AISI 51440; AISI 30347; N-155; Teflon; Kel-F; ultimate tensile strength; tensile yield strength; elongation; reduction in area; hardness; thermal expansion; -423 F

247. Bowers, W. D., "Cryogenic Tensile Properties of 18% Ni-Co-Mo Steel", Technical Report M-2132, Aerojet-General Corporation (March 19, 1963).

Maraging (350); ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; -423 F

248. Bowers, W. D., "Cryogenic Tensile Properties of Inconel 718", Technical Report M-2131, Aerojet-General Corporation (April 18, 1963).

Inconel 718; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; -423 F

249. Brisbane, A. W., "The Influence of Loading Rate and Stress Concentration Factors on Notch Properties of Three Sheet Alloys at Room Temperature, -78 C, and -196 C", Proceedings of the 1962 Cryogenic Engineering Conference, 641-653 (1963).

AISI 301; Rene 41; Vascojet 1000; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -196 C

250. Christian, J. L., Hurlich, A., Chafey, J. E., and Watson, J. F., "Mechanical Properties of Titanium-5Al-2.5Sn Alloy at Room and Cryogenic Temperatures", Technical Report AR-592-1-373, Astronautics/General Dynamics (1963).

Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

251. Christian, J. L., and Kerr, J. R., "Selection of Optimum Materials for Use in Liquid-Hydrogen-Fueled Aerospace Vehicles", ASD-TDR-63-798, Astronautics/General Dynamics, WPAFB Contract AF 33(657)-9445 (October 1963).

L-605; Hastelloy X; Rene 41; R-235; Inconel 718; Ti-5Al-2.5Sn; Ti-8Al-1Mo-1V; Ti-13V-11Cr-3Al; AISI 301; AISI 310; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; fatigue properties; -423 F

252. Christian, J. L., and Hurlich, A., "Physical and Mechanical Properties of Pressure Vessel Materials for Application in a Cryogenic Environment. Part II", ASD-TDR-62-258, Part II, Astronautics/General Dynamics, WPAFB Contract AF 33(616)-7719 (April 1963).

AISI 301; AISI 310; Rene 41; 2014-T6; 2219-T81; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; hardness; notch tensile strength; fracture toughness; weld properties; -423 F

253. Christian, J. L., "Selection of Materials for Saturn Vehicle (S-11)", Technical Report MRG-192, General Dynamics, Contract AF 33(616)-7984 (March 1963).

AISI 304L; AISI 310; Ti-5Al-2.5Sn; 2014-T6; 5052-H38; 6061-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; impact properties; -423 F

254. Davey, G., and Mendelssohn, K., "Heat Conductivity of Pure Metals Below 1 K", Physics Letters, 7 (3), 183-184 (November 15, 1963).

Copper; gold; iron; titanium; thermal conductivity; 0.2 K

255. DeBoisblanc, W. R., "Tensile Testing of 18% Ni Maraging Steel at -423 F", Technical Report M-2143, Aerojet-General Corporation (July 23, 1976).

Maraging steel; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; -423 F

256. DeBoisblanc, W. R., "Cryogenic Tensile Properties of 6061-T6 Aluminum and 5Al-2.5Sn ELI Titanium", Technical Report M-2137, Aerojet-General Corporation (May 23, 1963).

6061-T6; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

257. DeMoney, F. W., "Proposed Case For Aluminum Alloy 7039-T61 & -T6151", submitted to the ASME Boiler & Pressure Vessel Code Committee (October 24, 1963).

7039-T61; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; weld properties; -423 F

258. DeSisto, T. S., "Low Temperature Mechanical Properties of Base and Weld Deposits of Selected Austenitic Stainless Steels", Technical Report AMRA-TR-63-08, Watertown Arsenal (July 1963).

AISI 301; AISI 310; AISI 316; AISI 347; ultimate tensile strength; notch tensile strength; elongation; reduction in area; weld properties; impact properties; -269 C

259. Fenton, E. W., Rogers, J. S., and Woods, S. B., "Lorenz Numbers of Pure Aluminum, Silver, and Gold at Low Temperatures", Canadian Journal of Physics, 41, 2026-2033 (1963).

Aluminum; silver; gold; thermal conductivity; electrical conductivity; 2 K

260. Gill, R. S., "Comparative Tensile and Fatigue Properties at Room Temperature and at -423 F of Some Welded Centaur Tank Joint Configurations", Technical Report NASA CR-54689, General Dynamics, Contract NAS 3-3232 (October 11, 1963).

AISI 301; AISI 310; ultimate tensile strength; weld properties; fatigue properties; -423 F

261. Gruner, J. D., "The Effects of Chemical Milling and Chemically Milled Steps on the Mechanical Properties of Type 301 EH and Type 310 EH Stainless Steels at Room and Liquid Hydrogen Temperatures", Technical Report AR-592-1-473, Convair/General Dynamics (July 3, 1963).

AISI 301; AISI 310; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; fatigue properties; -423 F

262. Henry, W. G., and Schroeder, P. A., "The Low-Temperature Resistivities and Thermopowers of Alpha-Phase Copper-Zinc Alloys", Canadian Journal of Physics, 41, 1076-1093 (1963).

Copper; Cu-10Zn; Cu-25Zn; electrical resistivity; thermal conductivity; specific heat; 4.2 K

263. Ho, J. C., O'Neal, H. R., and Phillips, N. E., "Low Temperature Heat Capacities of Constantan and Manganin", Review of Scientific Instruments, 34 (7), 782-783 (July 1963).

Cu-13Mn (Manganin); Cu-43Ni (Constantan); specific heat; 4.2 K

264. Hooper. A. F., and Christian, J. L., "Mechanical Properties of Titanium-5Al-2.5Sn Alloy at Room and Cryogenic Temperatures", Technical Report, General Dynamics, Contract AF 33 (616)-7984 (March 1963).

Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

265. Hooper, A. F., and Christian, J. L., "Evaluation of 2017-T4, 2117-T4, and 5056-H32 Aluminum Alloys at Cryogenic Temperatures", Technical Report AR-592-1-375, General Dynamics, Contract AF 33(616)-7984 (March 1963).

2017-T4; 2217-T4; 5056-H32; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; -423 F

266. Hurlich, A., and Scheck, W. G., "Evaluation and Application of Stainless Steels in Cryogenic Environments", Advances in the Technology of Stainless Steels and Related Alloys, ASTM Special Technical Publication No. 369, pp 127-135 (1963).

AISI 301; AISI 304L; AISI 310; ultimate tensile strength; tensile yield strength; elongation; -423 F

267. Kaufman, J. G., and Johnson, E. W., "Notch Sensitivity of Aluminum Alloy Sheet and Plate at -320 F Based Upon Notch-Yield Ratio", Proceedings of the 1962 Cryogenic Engineering Conference, 678-685 (1963).

2014; 2020; 2024; 2219; 5154; 5454; 5456; 6061; 7075; 7079; 7178; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -320 F

268. Kaufman, J. G., Nelson, F. G., and Johnson, E. W., "Properties of Aluminum Alloy 2219 Sheet, Plate, and Welded Joints at Low Temperatures", Proceedings of the 1962 Cryogenic Engineering Conference, 661-670 (1963).

2219; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; weld properties; impact properties; -320 F

269. Keys, R. D., and Schwartzberg, F. R., "Techniques for Axial Testing of Sheet Materials Down to -423 F", Paper presented at the Sixty-Sixth Meeting of the American Society for Testing and Materials, Atlantic City, New Jersey (June 23-28, 1963).

5456-H343; Ti-5Al-2.5Sn; fatigue properties; -423 F

270. LeBlanc, M.A.R., "Behavior of the Magnetization and Transport Current in NbZr Wire", Physics Letters, 6 (2), 140-143 (September 1, 1963).

Nb-25Zr; magnetization, 4.2 K

271. Lorenz, P. M., South-Worth, H. L., Fleming, F. C., and Ottlyk, A. A., "Investigation of Low-Cycle Fatigue Failures Using Applied Fracture Mechanics", Technical Progress Report, Boeing Company (June 1963).

D6AC; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; reduction in area; fracture toughness; -320 F

272. Lovoy, C. V., "Low Temperature Mechanical Properties of Aluminum Alloys X2119 and 2219", Internal Note IN-P&VE-M-63-4, MASA George C. Marshall Space Flight Center (March 27, 1963).

2119-T6; 2219-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

273. Meyer, G., "Magnetic Properties of Superconducting Nb-Sn Sintered Samples", Physics Letters, 7 (2), 93-94 (November 1, 1963).

Nb_3Sn; magnetic properties; 17.6 K

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Unitemp 212; A-286; Ti-6Al-4V; Waspalloy; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

275. Pendleberry, S. L., "Fracture Strength of 6Al-4V-Ti, 5Al-2.5Sn-Ti, and 2014-T6 Al Sheet Containing Shallow Cracks at Room Temperature and -423 F", Transactions of the ASM, 56, 744-752 (1963).

Ti-6Al-4V; Ti-5Al-2.5Sn; 2014-T6; fracture properties; -423 F

276. Radhakrishna, P., and Nielsen, M., "Thermal Conductivity of Niobium-Zirconium Alloys at Low Temperatures", Physics Letters, 6 (1), 36-38 (August 15, 1963).

Nb-0.2Zr; Nb-2Zr; thermal conductivity; 1.6 K

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Aluminum; copper; 2014-T6; 2219-T81; 5456-H343; 7075-T6; 7079-T6; Inconel X-750; Rene 41; 17-7PH; A-286; Carpenter 20Cb; AISI 301; AISI 347; AISI 410; Ti-6Al-4V; thermal expansion; -255 C

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5083-0; 5083-H113; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; -452 F

279. Schwartzberg, F. R., Keys, R. D., Brown, M. J., and Reightler, C. L., "Determination of Low-Temperature Fatigue Properties of Aluminum and Titanium Alloys", NASA CR-63-29, The Martin Company, Contract NAS 8-2631 (July 1963).

2014-T6; 2219-T87; 2020-T6; 5456-H343; 7075-T6; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-13V-11Cr-3Al; ultimate tensile strength; tensile yield strength; elongation; weld properties; modulus of elasticity; fatigue properties; -423 F

280. Shannon, J. L., Jr., and Brown, W. F., Jr., "Effects of Several Alloy Production and Fabrication Variables on the Sharp Notch Properties of 5Al-2.5Sn-Ti Sheet at Liquid Hydrogen Temperature", Paper presented at the Annual ASTM Meeting, Atlantic City, New Jersey (June 23, 1963).

Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; notch tensile strength; weld properties; fracture toughness; -423 F

281. Srawley, J. E., and Lupton, T. C., "Tensile and Impact Properties of Some Maraging Steel Compositions", Technical Report NRL-5916, Naval Research Laboratory (April 1963).

Maraging (200); ultimate tensile strength; tensile yield strength; reduction in area; elongation; impact properties; -20 F

282. Swartz, P. S., "Evidence for the Negative Surface Energy Models of Superconductivity in Nb_3Sn, Nb_3Al, V_3Ga, and V_3Si", Journal of Applied Physics, 34 (4), 1365-1366 (April 1963).

Nb_3Sn; V_3Ga; superconductivity; magnetization; 4.2 K

283. Tiffany, C. F., Lorenz, P. M., Southworth, H. L., Pall, F. A., Ottlyk, A. A., Fleming, F. C., and Robinson, V. R., "Investigation of Low-Cycle Fatigue Failures Using Applied Fracture Mechanics", Technical Progress Report, Boeing Company, WPAFB Contract AF 33(657)-10251 (October 1963).

Maraging (300); D6AC; fracture toughness; room temperature

Ti-6Al-4V; fracture toughness; -320 F

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1100 aluminum; 356-T6; 2020-T6; 2024-T86; 6061-T6; 7075-T6; Elgiloy; Stellite 3; Stellite 25; Berylco 25; Cu-30Zn; copper; Invar; Ni-Span C; Vascojet 1000; 17-4PH; 17-7PH; A-286; AISI 301; AISI 302; AISI 303; AISI 304L; AISI 310; AISI 321; AISI 347; AISI 410; AISI 416; AISI 440C; AISI 1075; AISI 4340; 9Ni steel; Inconel 600; Inconel X-750; Monel alloy K-500; nickel; Rene 41; Ti-5Al-2.5Sn; Ti-13V-11Cr-3Al; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; 20 K

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15-7PH; Ti-6Al-4V; Ti-4Al-3Mo-1V; Ti-5Al-2.75Cr-1.25Fe; Ti-8Al-1Mo-1V; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; fatigue properties; -320 F

286. Wroth, R. S., "Effect of Filler Metal Chemistry on the Mechanical Properties of Weldments in 2014-T6 Aluminum", Technical Report SM-43090, Douglas Aircraft Company (1963).

2014-T6; weld properties; ultimate tensile strength; tensile yield strength; elongation; -321 F

287. Ziegler, W. T., Mullins, J. C., and Hwa, S.C.P., "Specific Heat and Thermal Conductivity of Four Commercial Titanium Alloys for 20 to 300 K", Proceedings of the 1962 Cryogenic Engineering Conference, 268-277 (1963).

Ti-6Al-4V; Ti-4Al-3Mo-1V; Ti-13V-11Cr-3Al; Ti-16V-2.5Al; specific heat; thermal conductivity; 20 K

1964

288. "Armco 21-6-9 Stainless Steel", Product Data Bulletin S-10A, Armco Steel Corporation (1964).

21-6-9; ultimate tensile strength; tensile yield strength; elongation; thermal expansion; thermal conductivity; magnetic permeability; -320 F

289. "Fluorocarbon Plastics", Materials in Design Engineering, 59 (2), (February 1964).

Polytetrafluoroethylene; polychlorotrifluoroethylene; elongation; ultimate tensile strength; compressive strength; thermal expansion; electrical properties; -423 F

290. "Low Temperature and Cryogenic Steels: How to Choose, Use and Weld Them", Welding Design and Fabrication, 37 (4), 51-73 (April 1964).

3Ni steel; 9Ni steel; AISI 304; AISI 304L; AISI 302; AISI 310; AISI 316; AISI 321; AISI 347; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; impact properties; weld properties; -423 F

291. Alper, R. H., "Cryogenically Stretch-Formed Type 301 Stainless Steel for Cryogenic Service", Materials Research & Standards, 4 (10), 525-532 (October 1964).

AISI 301; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -320 F

292. Alper, R. H., "Development of High Strength Alloys by Cryogenic Stretchforming", Final Report, Part I, Arde-Portland, Inc., Contract NOw-63-0387-c (September 17, 1964).

AISI 301; ultimate tensile strength; elongation; weld properties; -320 F

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7002; 7005; 7006; 7039; 7106; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

294. Bringer, R. P., "CTFE Fluorocarbons", Machine Design, 36 (22), 73-75 (September 17, 1964).

Polychlorotrifluoroethylene; thermal expansion; -423 F

295. Brink, N. O., "Mechanical Behavior of Reinforced Plastics at Cryogenic Temperatures", SPE Journal, 20 (10), 1123-1131 (October 1964).

Resin matrix composites; ultimate tensile strength; flexure strength; compressive strength; compressive modulus; fatigue properties; -424 F

296. Broadwell, R. G., and Wood, R. A., "Titanium Alloys for Cryogenic Service", Materials Research & Standards, 4 (10), 549-554 (October 1964).

Ti-13V-11Cr-3Al; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-6.5Al; Ti-8Al; Ti-6Al-6V-2Sn; Ti-8Al-1Mo-1V; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; impact properties; -423 F

297. Bukh, A., "Band of the Boundary of Fatigue With Other Mechanical Properties on Metal", Translation of Mashinostroene, (4), 20-23 (1964).

Aluminum alloys; fatigue properties; -320 F

298. Burdekin, F. M., "The Fracture Strength of Welded 3½% and 9% Nickel Steels at Low Temperature", British Welding Journal, 11, 586-592 (November 1964).

3Ni steel; 9Ni steel; fracture properties; impact properties; -196 C

299. Campbell, J. E., "Evaluation of Special Metal Properties", Technical Report, Battelle Memorial Institute (September 1964).

Aluminum alloys; nickel alloys; titanium alloys; stainless steel; ultimate tensile strength; tensile yield strength; elongation; fracture toughness; fatigue properties; -423 F

300. Campbell, J. E., "Aluminum Alloys for Cryogenic Service", Materials Research & Standards, 4 (10), 540-548 (October 1964).

2014-T6; 2024-T4; 2219-T81; 5083-H38; 5456-H321; 6061-T6; 7079-T6; 7039-T6; 7106; 355-T6; 356-T6; ultimate tensile strength; tensile yield strength; elongation; weld properties; modulus of elasticity; notch tensile strength; fatigue properties; -423 F

301. Carr, R. H., McCammon, R. D., and White, G. K., "The Thermal Expansion of Copper at Low Temperatures", Proceedings of the Royal Society of London, 280, 72-84 (August 11, 1964).

Copper; thermal expansion; 2 K

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Resin matrix composites; ultimate tensile strength; compressive strength; compressive modulus; flexure strength; bearing properties; fatigue properties; -423 F

303. Christian, J. L., Yang, C. T., and Witzell, W. E., "Physical and Mechanical Properties of Pressure Vessel Material for Application in a Cryogenic Environment", Summary Report GD/A 63-0818-3, Astronautics/General Dynamics, Contract AF 33(657)-11289, Phase II (May 15, 1964).

AISI 304; AISI 310; Maraging (250); Rene 41; Hastelloy B; Inconel 718; 7039-T6; 2219-T81; Ti-5Al-2.5Sn; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; fracture toughness; weld properties; -423 F

304. Christian, J. L., Yang, C. T., and Witzell, W. E., "Physical and Mechanical Properties of Pressure Vessel Materials for Application in a Cryogenic Environment. Part III", Technical Report ASD-TDR-62-258-Part 3, General Dynamics, Contract AF 33(657)-11289 (December 1964).

AISI 304; AISI 310; maraging (250); Rene 41; Hastelloy B; Inconel 718; 7039-T6; 2219-T81; Ti-5Al-2.5Sn; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; fracture toughness; weld properties; -423 F

305. Christian, J. L., "Effects of Chemistry and Processing on the Mechanical Properties of Engineering Alloys at Cryogenic Temperatures", Metals Engineering Quarterly, 4 (3), 53-63 (August 1964).

AISI 301; AISI 310; AM 355; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-8Al-2Cb-1Ta; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

306. Cody, G. D., and Cohen, R. W., "Thermal Conductivity of Nb_3Sn", Reviews of Modern Physics, 36 (1), 121-123 (January 1964).

Nb_3Sn; thermal conductivity; 2.6 K

307. Collings, E. W., Hedgcock, F. T., et al, "Magnetic and Electrical Properties of Some Ternary Mg-Mn-Al Alloys at Low Temperatures", Philosophical Magazine, Series 8, 10 (103), 159-167 (July 1964).

Magnesium alloys; electrical resistivity; magnetic susceptibility; magnetoresistance; 4.2 K

308. Cribier, D., Farnoux, B., Jacrot, B., Rao, L. M., et al, "Neutron Diffraction by Vortex Lines in Superconducting Niobium", Paper presented at the International Conference on Magnetism, Nottingham (September 1964).

Niobium; magnetic induction; superconductivity; 4.2 K

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Nb_3Sn; superconductivity; 4.2 K

310. D'Annessa, A. T., and Friend, R. E., "Properties of X7000-Series Aluminum Alloy Weldments", Welding Journal, Welding Research Supplement, 43, 337s-343s (August 1964).

7002; 7006; 7039; ultimate tensile strength; tensile yield strength; elongation; weld properties; -320 F

311. DeMoney, F. W., "Performance of a New Cryogenic Aluminum Alloy, 7039", Proceedings of the 1963 Cryogenic Engineering Conference, 112-123 (1964).

7039-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -320 F

312. Denaburg, C. R., "Low Temperature Mechanical Properties of 8Al-1Mo-1V Titanium Alloys and Composite Weldments", Technical Memorandum NASA TM X-53178 (December 11, 1964).

Ti-6Al-4V; Ti-8Al-1Mo-1V; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -253 C

313. DeSisto, T. S., and Carr, F. L., "The Influence of Subzero Rolling on the Tensile Properties of Commercially Pure Titanium ", Technical Report AMRA TR-64-47, Watertown Arsenal (December 1964).

Ti-55A; ultimate tensile strength; elongation; reduction in area; -320 F

314. DeSorbo, W., "Resistive Transition and Current Density Characteristics in Superconducting Niobium Containing Dissolved Gases", Physical Review, 134 (5A), A1119-A1135 (June 1, 1964).

Niobium; superconductivity; 4.2 K

315. DeSorbo, W., "The Influence of Impurities and Solutes (Primarily Zirconium) on the High-Current-Carrying, High-Field Nb_3Sn Superconductor", Cryogenics, 4 (2), 218-232 (August 1964).

Nb_3Sn; superconductivity; 4.2 K

316. Dupre, A., Van Itterbeek, A., and Michiels, L., "Heat Conductivity of Copper Below 1 K", Physics Letters, 8 (2), 99-100 (January 15, 1964).

Copper; thermal conductivity; below 1 K

317. Eichenberger, T. W., "Mechanical Property and Fracture Toughness Evaluation of 2219-T6E46 for Cryogenic Applications", Final Report D2-81287, Boeing Company, Contract AF 33(615)-1624 (July 16, 1964).

2219-T6E46; ultimate tensile strength; tensile yield strength; notch tensile strength; creep properties; fatigue properties; fracture toughness; -423 F

318. Evans, R. M., "The Welding and Brazing of Alloy 718", DMIC Report 204 (June 1, 1964).

Inconel 718; weld properties; fracture toughness; -320 F

319. Flannery, J. W., and Witherell, C. E., "Welding 3½ and 9 Percent Nickel Steels and 36 Percent Nickel-Iron Alloy for Cryogenic Service", Materials Research & Standards, 4 (10), 533-539 (October 1964).

3Ni steel; 9Ni steel; Invar; ultimate tensile strength; tensile yield strength; elongation; impact properties; weld properties; -423 F

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Nb-25Zr; ultimate tensile strength; tensile yield strength; reduction in area; 4.2 K

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Cu-12Mn-4Ni (Manganin); Cu-43Ni (Constantan)(Advance); Ni-20Cr (Karma); Ni-20Cr-2.5Al-2.5Cu (Evanohm); electrical resistivity; 10 K

322. Girton, L. D., "Evlauation of Sheet Alloy 718 for Formed and Welded Missile Parts", Technical Report GD/A-ERR-AN-656, General Dynamics/Astronautics (December 1964).

Inconel 718; AISI 301; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; shear ultimate strength; weld properties; -423 F

323. Gruner, J. D., "Additional Information Pertaining to the Effects of Chemical Milling on the Mechanical Properties of Cold Rolled Stainless Steel", Technical Report AR 592-1-521, General Dynamics/Astronautics (April 16, 1964).

AISI 301; AISI 310; ultimate tensile strength; tensile yield strength; elongation; fatigue properties; weld properties; -423 F

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Iron alloys; vanadium alloys; manganese alloys; nickel alloys; cobalt alloys; specific heat; 1.4 K

325. Hamilton, H., and Katcher, M., "Which Metals For Cryogenic Applications?", Materials in Design Engineering, 59 (5), 83-86 (May 1964).

Ti-6Al-4V; Ti-5Al-2.5Sn; AISI 301; AISI 310; A-286; 2014-T6; 2024-T3; 2219-T81; 6061-T6; Inconel X-750; Rene 41; L-605; -423 F; ultimate tensile strength; tensile yield strength; -320 F

326. Haskins, J. F., Campbell, M. D., Hertz, J., and Percy, J. L., "Thermophysical Properties of Plastic Materials and Composites to Liquid Hydrogen Temperature (-423 F)", Technical Documentary Report ML-TDR-64-33, Part I, General Dynamics/Astronautics, Contract AF 33(657)-9160 (June 1964).

Fiber reinforced composites; resin matrix composites; specific heat; thermal conductivity; thermal expansion; -423 F

327. Heiniger, F., and Muller, J., "Bulk Superconductivity in Dilute Hexagonal Titanium Alloys", Physical Review, 134 (6A), A1407-A1409 (June 15, 1964).

Titanium alloys; superconductivity; specific heat; -320 F

328. Inouye, F. T., "Inconel 718 Mechanical Properties at -423 F", Technical Report 64-132, Aerojet-General Corporation (January 31, 1964).

Inconel 718; ultimate tensile strength; tensile yield strength; elongation; -423 F

329. Jolley, C. E., Homsy, C. A., and Reed, J. C., "TFE-FEP Fluorocarbons", Machine Design, 36 (22), 67-73 (September 17, 1964).

Polytetrafluoroethylene; ultimate tensile strength; tensile yield strength; elongation; flexural modulus; compressive strength; thermal conductivity; -420 F

330. Jolley, W., and Hull, D., "Effect of Prestrain Aging on the Brittle Fracture of 3.25% Silicon Iron", Acta Metallurgica, 12, 1337-1352 (December 1964).

Fe-3.25Si; fracture properties; 77 K

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Aluminum; modulus of elasticity; 4.2 K

332. Kendall, E. G., "Metals and Alloys for Cryogenic Applications - A Review", Technical Report SSD-63-371, Aerospace Corporation, Contract AF04 (695)-269 (January 1964).

AISI 202; AISI 301; AISI 301; AISI 304L; AISI 310; A-286; AM355; Monel alloy K-500; Inconel X-750; Rene 41; L-605; Hastelloy B; 2014-T6; 2017-T4; 2024-T4; 2219-T87; 5052-H38; 5083-H38; 5086-H34; 5154-H38; 5456-H343; 6061-T6; 7075-T6; 7079-T6; 7178-T6; titanium; Ti-5Al-2.5Sn; Ti-5Al-5Zr-5Sn; Ti-6Al-4Zr-1V; Ti-7Al-12Zr; Ti-8Al-2Cb-1Ta; Ti-8Al-1Mo-1V; Ti-6Al-4V; Ti-13V-11Cr-3Al; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; fatigue properties; -423 F

333. Keys, R. D., and Schwartzberg, F. R., "Axial Fatigue Testing of Sheet Materials Down to -423 F", Materials Research and Standards, 4 (5), 222-224 (May 1964).

7075-T6; 5456-H343; Ti-5Al-2.5Sn; fatigue properties; -423 F

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Aluminum; plastic deformation; stress strain data; 1.3 K

335. Lerner, E., Wilson, M. F., Gaines, J. R., and Daunt, J. G., "Magnetic Properties of Cupron Wire at Low Temperatures", Review of Scientific Instruments, 35 (1), 117 (January 1964).

Cu-45Ni (Cupron); magnetization; 4.2 K

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Cu-43Ni (Advance); Ni-20Cr-2.5Al-2.5Cu (Evanhom); magnetoresistance; electrical resistivity; 4.2 K

337. Lismer, R. E., "Copper Alloys for Cryogenic Service - I", Metal Industry, 104 (16), 532-535 (April 16, 1964).

Cu-10Ni (Cupro–nickel); Cu-20Ni (Cupro-nickel); Cu-30Ni (Cupro-nickel); Cu-40Zn (brass); Cu-5Ni-1Fe (Kunifer 5); Cu-20Ni-1Fe (Kunifer 20); Cu-12Mn-7Al-2Ni-2Fe (Superston); notch tensile strength; impact properties; -196 C

338. Lismer, R. E., "Copper Alloys for Cryogenic Service - II", Metal Industry, 104 (17), 564-565 (April 23, 1964).

Cu-20Ni (Cupro-nickel); Cu-30Ni (Cupro-nickel); Cu-5Ni-1Fe (Kunifer 5); Cu-10Ni-1Fe (Kunifer 10); Cu-20Ni-1Fe (Kunifer 20); weld properties; -196 C

339. Livingston, J. D., and Schadler, H. W., "The Effect of Metallurgical Variables on Superconducting Properties", Progress in Materials Science, 12 (3), 185-284 (1964).

Superconductor materials; magnetic properties; electrical properties; review

340. Lorenz, P. M., "Fracture Toughness and Subcritical Flaw Growth Characteristics of Saturn SI-C Tankage Materials", Technical Report D2-22802, Boeing Company, Contract NAS 8-5608 (April 6, 1964).

2219-T87; ultimate tensile strength; tensile yield strength; elongation; reduction in area; weld properties; fracture toughness, -320 F

341. Lubell, M. S., and Chandrasekhar, B. S., "Wide Range Magnetic Field Measurements at 4.2 K", Review of Scientific Instruments, 35 (7), 906-908 (July 1964).

Copper; magnetoresistance; 4.2 K

342. Martin, H. L., "Effects of Low Temperatures on Structural Metals", Technical Report NASA SP-5012 (December 1964).

2014; 2020; 2119; 5052; 5086; 5456; 7002; 7075; 7079; 7178; 355; Carpenter 20Cb; A-286; AISI 202; maraging steel; Ti-6Al-4V; Ti-5Al-2.5Sn; Ti-13V-11Cr-3Al; Inconel X-750; Waspalloy; Monel alloy K-500; Rene 41; LA-91; LA-141; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

343. Martin, W. J., Matsuda, T., and Kaluza, E. F., "Study of Titanium Alloy Tankage at Cryogenic Temperatures", Technical Report AM-43116, Douglas Aircraft Company (May 1964).

Ti-6Al-4V; Ti-5Al-2.5Sn; weld properties; -423 F

344. Mathes, K. N., "Electrical and Mechanical Behavior of Polymers at Cryogenic Temperatures", SPE Journal, 20 (7), 634-637 (July 1964).

Polytetrafluoroethylene; polyethylene; dielectric properties; flexure strength; 4.2 K

345. McConville, T., and Serin, B., "Thermal and Magnetic Properties of Second Kind Superconductors. III. Specific Heat of Nb in a Magnetic Field", Reviews of Modern Physics, 36 (1), 112-116 (January 1964).

Niobium; specific heat; 0.06 K

346. McEvoy, J. P., Jr., Decell, R. F., and Novak, R. L., "Effect of Neutron Irradiation on Critical Currents in Hard Superconductors (Nb_3Sn and NbZr)", Applied Physics Letters, 4 (3), 43-45 (February 1, 1964).

Nb_3Sn; Nb-25Zr; superconductivity; 4.2 K

347. "9% Nickel Steel for Low Temperature Service", Manufacturers' Literature, International Nickel Company, Inc.

9Ni steel; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; weld properties; thermal expansion; magnetic properties; -300 F

348. Mishler, H. W., "Steels for Piping Systems with Maximum Pressures of 10,000 psi, and Operating Between -150 and +150 F", Technical Report RSIC-327, Battelle Memorial Institute, Contract DA-01-021-AMC-2037 (November 1964).

9Ni steel; weld properties; impact properties; fracture properties; -150 F

349. Mueller, C. B., and Saur, E. J., "Influence of Mechanical Constraints on Critical Currents of Superconducting Surface Layers of Nb_3Sn on Niobium and V_3Ga on Vanadium in Transverse Magnetic Fields", Proceedings of the 1963 Cryogenic Engineering Conference, 338-341 (1964).

Nb_3Sn; V_3Ga; superconductivity; 14 K

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Copper, copper alloys; magnetic properties; 4.2 K

351. Orange, T. W., "Tensile Coupon Tests of Cryoformed AISI 301 Stainless-Steel Pressure Vessels at Cryogenic Temperatures", NASA Technical Note NASA TN D-2202 (October 1964).

AISI 301; ultimate tensile strength; tensile yield strength; notch tensile strength; fracture toughness; -423 F

352. Peters, R. L., "Specific Heats of Materials at Low Temperatures", Materials in Design Engineering, 59 (5), 87 (May 1964).

Aluminum; beryllium; cobalt; copper; iron; magnesium; molybdenum; nickel; niobium; tin; titanium; tungsten; vanadium; specific heat; nomograph; -450 F

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Copper; cadmium; gallium; specific heat; 0.2 K

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AISI 302; AISI 303; AISI 310; modulus of elasticity; shear modulus; 20 K

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Nickel; Ni-26Fe; Ni-37Fe; Ni-59Fe; magnetization; 4.2 K

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Nb-25Zr; superconductivity; 4.2 K

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2014-T6; 2219-T87; 2219-T62; 7039-T6; 5456-H343; 7075-T6; 2020-T6; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-13V-11Cr-3Al; AISI 321; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; weld properties; fatigue properties; -423 F

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Copper; thermal expansion; 4.2 K

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Ti-5Al-2.5Sn; Ti-6Al-4V; AISI 321; AISI 347; AM 350; A-286; maraging (250); Hastelloy C; Inconel X-750; Alloy 713C; A356-T6; 2219-T81; 5456-0; 6061-T6; 7079-T6; Teflon; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; -423 F

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Aluminum; plastic deformation; electrical resistivity; 4 K

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Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; reduction in area; fracture toughness; -320 F

362. Toth, J. M., "Barrier Films for Filament-Wound Fiberglass Cryogenic Vessels", Advances in Cryogenic Engineering, 9, 537-544 (1964).

Teflon; Mylar; fiberglass composites; thermal contraction; elongation; compressive properties; -423 F

363. Vance, R. W., "Introduction to Cryogenics: Materials Behavior", Machine Design, 36 (24), 176-179 (October 8, 1964).

Copper; silver; aluminum; titanium; nickel; Teflon; AISI 302; AISI 316; AISI 304; AISI 310; 2024-T6; Ti-5Al-2.5Sn; 2014-T6; tensile yield strength; ultimate tensile strength; specific heat; thermal conductivity; 4.2 K

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Niobium; specific heat; 0.4 K

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Invar; Fe-36Ni; weld properties; impact properties; -320 F

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7178-T6; 7106-T63; 7039-T651; ultimate tensile strength; tensile yield strength; elongation; reduction in area; fracture toughness; -320 F

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2014; 2020; 2119; 5052; 5086; 5456; 7002; 7075; 7079; 7178; 355; A356; Carpenter 20-Cb; A-286; AISI 202; 18Ni maraging; Ti-6Al-4V; Ti-5Al-2.5Sn; Ti-13V-11Cr-3Al; Inconel X-750; Waspalloy; Monel alloy K-500; Rene 41; LA-91; LA-141; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

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7039-T61; 7039-T64; 2219-T62; 7079-T6; 5083-H113; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; impact properties; -320 F

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Aluminum; thermal conductivity; electrical resistivity; 4.2 K

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Inconel 718; ultimate tensile strength; tensile yield strength; elongation; weld properties; -423 F

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Aluminum; Al-2Mg; Al-4Mg; Al-6Mg; Al-8Mg; Al-10Mg; magnetic susceptibility; specific heat; 77 K

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Aluminum; copper; flow properties; stress-strain data; 0 K

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Invar; specific heat; 1.4 K

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Aluminum alloys; chromium alloys; nickel alloys; titanium alloys; stainless steel; mechanical properties; -423 F

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AISI 321; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-13V-11Cr-3Al; 2014-T6; 2219-T6E46; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; fatigue properties; fracture mechanics; -423 F

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Polytetrafluoroethylene (Teflon); thermal expansion; -253 C

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Mylar; fiberglass; laminates; thermal contraction; tensile properties; -320 F

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Copper; lead; thermal expansion; 10 K

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2014-T6; 2024-T3; 2024-T4; 2219-T81; 2219-T87; 6061-T4; 6061-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; modulus of elasticity; -423 F

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Nb-1Zr; Nb-2.6Zr; Nb-3.5Zr; magnetization; ultrasonic studies; 4.2 K

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Nb_3Sn; magnetization; specific heat; superconductivity; 18 K

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Copper; aluminum; niobium; titanium; zirconium; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; 77 K

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7039; 7006; 7002; weld properties; impact properties; fracture toughness; -320 F

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TD-Nickel; ultimate tensile strength; tensile yield strength; elongation; -423 F

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2219-T87; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -253 C

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Ti-6Al-6V-2Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; impact properties; fracture toughness; -269 C

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7075-T6; 5086-0; 5086-H32; Beryllium-copper; Monel K-500; ZK60A-T6; AZ31B-H24; 6061-T6; AISI 310; brass; AZ92-T6; Inconel X-750; magnetic properties; -320 F

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17Cr steel; specific heat; 1.3 K

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Aluminum; electrical resistivity; 4.2 K

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Copper; silver; gold; aluminum; iron; nickel; thermal expansion; 20 K

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OFHC copper; creep properties; shear stress; fatigue properties; 77 K

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Fe-3Si; Fe-48Ni; magnetic properties; 4 K

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Teflon; Kel-F; Mylar; nylon; polyvinyl chloride; ultimate tensile strength; elongation; impact properties; modulus of elasticity; compressive modulus; -423 F

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2024; 7075; AISI 301; AISI 321; Ti-5Al-2.5Sn; Ti-6Al-4V; copper; polystyrene; literature survey; specific heat; thermal conductivity; 8 R

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Copper; silver; gold; specific heat; 1.5 K

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Monel 400; AISI 1020; AISI 410; brass; thermal expansion; 18 K

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X7005; X7106; 7039; composites; brazing alloys; ultimate tensile strength; tensile yield strength; shear modulus; shear stress; compression properties; -423 F

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Ti-5Al-2.5Sn-2.5V-1Cb-1Ta; Ti-5Al-2.5V-1Cb-1Ta; Ti-6Al-3V-1Cb-1Ta-0.5Mo; Ti-5.5Al-5Sn-2.6Cb-2.5Ta-1V; Ti-6Al-4V-1Cb-1Ta;ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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Monel alloy K-500; Armco iron; Ta-10W; titanium; stress-strain data; -269 C

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Teflon; Kel-F; polystryene; Mylar; ultimate tensile strength; stress-strain data; radiation studies; -253 C

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Periodic system; electrical resistivity; magnetoresistance; -320 F

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Waspalloy; A-286; ultimate tensile strength; tensile yield strength; elongation; -423 F

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9Ni steel; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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X7106-T6; ultimate tensile strength; tensile yield strength; elongation; creep properties; compressive properties; stress-strain data; fatigue properties; weld properties; -423 F

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Polytetrafluoroethylene (Teflon); polychlorotrifluoroethylene (Kel-F); polyethylene, thermal conductivity; specific heat; 1 K

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Inconel 718; ultimate tensile strength; tensile yield strength; elongation; creep properties; -320 F

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Fiberglass composites; resins; polymers; stress-strain data; ultimate tensile strength; thermal contraction; 20 K

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Ti-5Al-2.5Sn; Ti-5Al-5Sn; Ti-5Al-2.5V; Ti-6Al-3V; Ti-7.5Al-2.5V; alloying additions; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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AISI 301; AISI 4340; AISI 310; 17-7PH; Rene 41; L-605; aluminum; 2014-T6; 5085-H34; 7075-T6; Ti-5Al-2.5Sn; Ti-75A; Ti-6Al-4V; Ti-13V-11Cr-3Al; beryllium-copper; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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Ti-5Al-2.5Sn; Ti-6Al-4V; AISI 321; AISI 347; AM 350; A-286; maraging (250); Hastelloy C; Inconel X-750; Alloy 713C; A356-T6; 2219-T87; 5456-0; 6061-T6; 7079-T6; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; -423 F

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A356-T6; 6061-T6; 7075-T6; 7079-T6; 2219-T81; 5456-H321; 5456-0; Ti-5Al-2.5Sn; A-286; 17-7PH; AM 350; AISI 304; AISI 321; AISI 347; AISI 410; Inconel X-750; Hastelloy C; ultimate tensile strength; shear ultimate strength; -423 F

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Copper; specific heat; 1.3 K

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2024-T4; beryllium copper; Monel alloy K-500; titanium; AISI 304; AISI 1020; 9Ni steel; Teflon; ultimate tensile strength; tensile yield strength; fatigue properties; impact properties; modulus of elasticity; thermal conductivity; thermal expansion; 0 R

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Nb_3Sn; V_3Ga; V_3Si; Nb-2Zr; magnetic properties; superconductivity; 4.2 K

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2014-T6; 2219-T87; 7106-T6; composites; ultimate tensile strength; tensile yield strength; elongation; weld properties; compressive strength; -320 F

438. Bennett, F. W., and Dillon, C. P., "Impact Strength of Austenitic Stainless Steel Welds at -320 F - Effects of Composition, Ferrite Content, and Heat Treatment", Transactions of the ASME Journal of Basic Engineering, 88, 33-36 (March 1966).

AISI 304; AISI 310; AISI 308L, impact properties; weld properties; -320 F

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Aluminum; electrical resistivity; magnetoresistance; 4.2 K

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Aluminum alloys; nickel alloys; beryllium alloys; mechanical properties; -423 F

441. Carman, C. M., Forney, J. W., and Katlin, J. M., "Plane Strain Fracture Toughness and Mechanical Properties of 5Al-2.5Sn ELI Titanium at Room and Cryogenic Temperatures", Final Report, NASA CR-54296, Frankford Arsenal, NASA Purchase Order C6860A (April 1966).

Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; fracture toughness; -423 F

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2219-T87; ultimate tensile strength; tensile yield strength; elongation; reduction in area; fracture toughness; -423 F

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Niobium; copper; composites; superconductivity; 4.2 K

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Copper, Cu-6Sn; Cu-2.7Zn; specific heat; 2 K

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2219; 7106; Ti-5Al-2.5Sn; Ti-8Al-1Mo-1V; AISI 321; Inconel 600; Inconel 718; hardness; thermal expansion; shear stress; weld properties; -423 F

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Niobium; specific heat; 77 K

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Ti-6Al-4V; modulus of elasticity; ultimate tensile strength; tensile yield strength; reduction in area; -423 F

448. Du Chatenier, F. J., and DeNobel, J., "Heat Capacities of Pure Copper and Silver and of Dilute Alloys of Cu, Ag, Zn, Mg and Al With Transition Metals of the First Row at Low Temperatures", Physica, 32, 1097-1109 (1966).

Copper; copper alloys; silver; silver alloys; zinc alloys; magnesium alloys; aluminum alloys; specific heat; 1.3 K

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2219-T87; Ti-5Al-2.5Sn; fracture mechanics; fatigue properties; -423 F

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Nb_3Sn; Nb_6Sn_5; superconductivity; 4.2 K

451. Ferguson, C. W., "Hypervelocity Impact Effects on Liquid Hydrogen Tanks", Final Report, NASA CR-54852, Douglas Missile & Space Systems, Contract NAS 3-4193 (March 31, 1966).

2219-T87; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; fracture toughness; -423 F

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Armco iron; thermal conductivity; electrical resistivity; -269 C

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Polymethyl methacrylate; thermal conductivity; -320 K

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Niobium alloys; niobium compounds; electrical resistivity; specific heat; thermal conductivity; magnetic hysteresis; magnetic susceptibility; -320 F

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1100 aluminum; fatigue properties; -320 F

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X2021; X7007; 2219; X7106; 5456; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -320 F

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Copper; magnetic susceptibility; 6 K

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Pyrex; Teflon; magnetic susceptibility; 6.1 K

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461. Inouye, F. T., "Properties of Large 7079 Aluminum Alloy Forgings in a Cryogenic Environment", Technical Report NASA-CR-513, Aerojet-General Corporation, Contract NAS 3-2555 (July 1966).

7079-T6: 7075-T6; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; fatigue properties; -423 F

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AISI 9310; maraging (250); AISI 347; Inconel 718; Inconel X-750; AISI 440C; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; weld properties; shear ultimate strength; shear modulus; -320 F

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X7005; X7106; 7039; brazing alloys; composites; ultimate tensile strength; tensile yield strength; elongation; shear ultimate strength; shear modulus; compression properties; -423 F

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Ti-5Al-2.5Sn-2.5V-1Cb-1Ta; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

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Niobium; ultimate tensile strength; elongation; strain rates; -196 C

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Copper; silver; gold; specific heat; 3 K

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Iron; deformation; reduction in area; stress-strain data; 4 K

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A-286; ultimate tensile strength; tensile yield strength; elongation; -423 F

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7039-T6; ultimate tensile strength; tensile yield strength; elongation; -423 F

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Inconel 718; AM 355; ultimate tensile strength; tensile yield strength; elongation; -423 F

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X7106; ultimate tensile strength; tensile yield strength; elongation; -423 F

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Ni-2Be-0.5Ti (Berylco Nickel 440); ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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Ti-6Al-4V; AISI 301; Inconel 718; 2219-T87; fiberglass composites; elongation; fracture toughness; fatigue properties; modulus of elasticity; weld properties; ultimate tensile strength; tensile yield strength; notch tensile strength; -423 F

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Nb-25Zr; magnetization; electrical resistivity; ultrasonic attenuation; thermal properties; 4.2 K

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Ni-2Be-0.5Ti (Berylco 440); ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; fracture toughness; -423 F

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Nickel; Ni-7Cu; Ni-12Cu; Ni-36Cu; Ci-35Ni; Cu-22Ni; shear modulus; modulus of elasticity; 0 C

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Polymethylmethacrylate; polystyrene; thermal conductivity; 1 K

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Polymethylmethacrylate; polystyrene; polytetrafluoroethylene; specific heat; 1 K

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7039-T61; 7039-T64; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -320 F

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Fiberglass composites; peel strength; -320 F

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X2021-T8E31; X7007-T6; 2219-T87; X7106-T6351; 5456-H343; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

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Armco iron; plastic deformation; flow properties; compressive properties; stress-strain data; 77 K

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Copper; aluminum; ultimate tensile strength; 0 K

Nb_3Sn; Nb-25Zr; V_3Ga; superconductivity; 4.2 K

Niobium; specific heat; 1 K

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Niobium; electrical resistivity; superconductivity; 5 K

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2219-T87; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; weld properties; fracture toughness; stress-strain data; -423 F

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Copper; polyethylene; specific heat; 2.4 K

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Phenolic asbestos; phenolic linen; phenolic glass; mechanical properties; irradiation tests; -423 F

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AISI 301; AISI 310; 2014-T6; crack propagation; fracture properties; -423 F

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Cu-43Ni-2.7Mn (Constantan); magnetic susceptibility; specific heat; 0.1 K

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Polyethylene; polystyrene; thermal expansion; -185 C

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18Cr steel; phase transformation; magnetic anisotropy; saturation magnetization; -320 F

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Nb-39Ti-20Zr; Nb-9Ti-43Zr; Nb-48Ti-32Zr; superconductivity; phase diagrams; 4.2 K

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Teflon; plexiglass; polyethylene; graphite; thermal expansion; specific heat; -100 C

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Nb-75Zr; superconductivity; 4.2 K

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Plexiglas; polystyrene; bend test; fracture properties; bend properties; -196 C

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6063; 5456; 6061; Ti-5Al-2.5Sn; Ti-6Al-4V; Ti-8Al-1Mo-1V; Ti-6Al-6V-2Sn; AISI 4340; compressive properties; creep properties; fracture properties; -423 F

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7039; 2219; Ti-6Al-4V; Ti-5Al-2.5Sn; Inconel 600; fracture toughness; -423 F

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Niobium; hardness; superconductivity; 4.2 K

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Hastelloy C; R-235; Rene 41; TD-Nickel; Inconel 718; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -423 F

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Titanium; stress-strain data; plastic deformation; strain rate; flow properties; 77 K

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Maraging (250); maraging (300); ultimate tensile strength; fracture toughness; -423 F

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7039-T61; ultimate tensile strength; tensile yield strength; elongation; weld properties; -320 F

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Nickel; Fe-29Ni-17.5Co (Kovar); Fe-42Ni-1Mn (Dumet); Fe-36Ni (Invar); AISI 304; AISI 410; AISI 416; magnetic properties; 77 K

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Fe-39.5Ni-1.5Ti; electrical resistivity; thermal conductivity; modulus of elasticity; Poisson's ratio; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; weld properties; -320 F

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Russian alloys; aluminum; AMTS; AMG3; AMG5V; AMG6; VAD1; D20; AK8; V92TS; ATSMU; V96; ultimate tensile strength; tensile yield strength; elongation; 4.2 K

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OFHC copper; mechanical properties; 20 K

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Nb_3Sn; superconductivity; magnetization; specific heat; 4.2 K

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Aluminum; electrical resistivity, 1.6 K

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Kromarc 58; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; thermal expansion; -423 F

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Inconel 718; ultimate tensile strength; tensile yield strength; elongation; weld properties; thermal expansion; -423 F

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Titanium; tensile yield strength; 4.2 K

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1100 aluminum; 2014; X2021; 2024; 2219; 3003; 5083; 5454; 5456; 6061; X7005; 7007; 7039; 7075; 7079; 7178; ultimate tensile strength; tensile yield strength; elongation; weld properties; notch tensile strength; -423 F

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9Ni steel; ultimate tensile strength; tensile yield strength; elongation; impact properties; fatigue properties; thermal conductivity; thermal expansion; specific heat; magnetic saturation; -320 F

525. Midgley, P., and Thackray, R. W., "The Tensile Properties of Some Structural Materials in the Temperature Range 20 C to -253 C: Part I, Aluminum Alloy Sheet HS30WP", Technical Memo 426, Rocket Propulsion Establishment (January 1967).

Aluminum alloys; British alloys; HS30; 6061; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; -253 C

526. Morrison, J. A., and Newsham. D.M.T., "Comment on Heat Capacity of Polyethylene From 2.5 to 30 K", Journal of Chemical Physics, 47 (7), 2511-2512 (October 1967).

Polyethylene; specific heat; 2.5 K

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2014-T6; Inconel 718; Ti-5Al-2.5Sn; AISI 301; ultimate tensile strength; tensile yield strength; modulus of elasticity; notch tensile strength; fatigue properties; -452 F

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Fe-3.5Si (silicon iron); notch tensile strength; compressive properties; 77 K

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Copper; specific heat; 1 K

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2014-T6; ultimate tensile strength; weld properties; -423 F

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Stainless steel; Kh18N10T; Russian alloys; impact toughness; tensile strength; plasticity; ductility; -196 C

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Nb-Sn; magnetic hysteresis; magnetic induction; 4.2 K

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Nb-Ti-Zr; magnetic properties; superconductivity; 4.2 K

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Nb_3Sn; Nb-25Zr; Ti-20Nb; V_3Si; superconductivity; 4.2 K

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Copper; Cu-5Zn (gliding metal); Cu-10Zn (commercial bronze); Cu-15Zn (red brass); Cu-20Zn (low brass); Cu-28Zn-1Sn (admiralty brass); Cu-30Zn (cartridge brass); Cu-35Zn (yellow brass); Cu-39Zn-1Sn (naval brass); Cu-40Zn (Muntz metal); Cu-10Ni; Cu-20Ni; Cu-30Ni; Cu-45Ni; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; fatigue properties; creep properties; modulus of elasticity; -423 F

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Copper; Cu-10Zn (commercial bronze); Cu-15Zn (red brass); Cu-28Zn-1Sn (Admiralty brass); Cu-39Zn-1Sn (naval brass); Cu-3Si (copper silicon); Cu-5Sn (phosphor bronze); Cu-6.6Al-2Fe (aluminum bronze); Cu-10Al-5Ni-3Fe (nickel aluminum bronze); Cu-2Ni-0.5Si (copper nickel silicon); Cu-10Ni-1Fe (copper nickel 10); Cu-30Ni (copper nickel 30); stress-strain data; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; impact properties; modulus of elasticity; shear modulus; 4 K

537. Romig, H. L., "Guaranteed Minimum Mechanical Properties, Type 310 Stainless Steel Welded With Inconel 92 (Incoweld A) Filler Alloy, at Cryogenic Temperatures", Materials and Processes Report MPR 7-176A-101, Rocketdyne/North American (June 13, 1967).

AISI 310; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch toughness; -423 F

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AISI 301; AISI 304; AISI 310; 2014-T6; 2219-T81; Ti-5Al-2.5Sn; Ti-6Al-4V; Hastelloy B; Rene 41; Inconel 718; fracture toughness; -423 F

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Polyethylene; Plexiglas; polystyrene; specific heat; 16 K

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Nickel; magnetic susceptibility; 77 K

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Ti-5Al-2.5Sn; fracture toughness; -423 F

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2219-T87; Ti-5Al-2.5Sn; fracture toughness; -423 F

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Polyethylene; specific heat; 2.5 K

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Aluminum alloys; Russian alloys; VAD1; AK8; V92TS; ATSMU; V96; weld properties; ultimate tensile strength; -269 C

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Nickel alloys; manganese alloys; magnetic permability; 77 K

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Nickel alloys; magnetic susceptibility; 14 K

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A356-T6; 6061-T6; 7075-T6; Ti-5Al-2.5Sn; AISI 347; AISI 410; A-286; Inconel X-750; Hastelloy C; D-979; ultimate tensile strength; shear ultimate strength; -423 F

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Fe-3Si; tensile yield strength; -196 C

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Invar; thermal expansion; 4.2 K

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Aluminum alloys; British alloys; H30(Al-1Mg-1Si); L71(Al-4.5Cu); DTD687(Al-5Zn-2.5Mg-1.5Cu); D 74S (Al-4.5Zn-1.25Mg); Hiduminium 48(Al-4.5Zn-2.25Mg); GB3033(Al-4.5Zn-3.3Mg); titanium alloys; DTD 5093 (Ti-5Al-2.5Sn); IMI 318A (Ti-6Al-4V); DTD 5133(Ti-2Cu); ultimate tensile strength; elongation; reduction in area; modulus of elasticity; fracture toughness; 20 K

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AISI 304; AISI 310; AISI 316; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; compressive strength; fatigue properties; -440 F

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Polyethylene terephthalate; Mylar; ultimate tensile strength; modulus of elasticity; 4 K

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Nb_3Sn; Nb-25Zr; superconductivity; 2 K

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Nb-20Ti; Nb-50Ti; superconductivity; 4.2 K

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AISI 304; AISI 304L; AISI 310; AISI 347; AISI 316; tensile properties; thermal expansion; specific heat; thermal conductivity; -423 F

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Copper; thermal expansion; 10 K

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Nb-25Zr; superconductivity; 4.2 K

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Aluminum alloys; titanium alloys; tensile properties; fracture mechanics; -423 F

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Ti-5Al-2.5Sn; fracture mechanics; -423 F

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Ti-5Al-2.5Sn; Ti-5Al-5Zr-5Sn; Ti-6Al-4Zr-1V; Ti-7Al-12Zr; Ti-8Al-2Cb-1Ta; Ti-8Al-1Mo-1V; Ti-6Al-4V; Ti-13V-11Cr-3Al; ultimate tensile strength; tensile yield strength; elongation; modulus of elasticity; notch tensile strength; weld properties; -423 F

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Nb_3Sn; superconductivity; 4.2 K

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Titanium; zirconium; thermal expansion; 10 K

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Cu-2.6 Alumina; shear stress; strain rate; 78 K

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Cu-5Ni; Cu-28Ni; Ni-35Cu; Ni-10Cu; stress-strain data; plastic deformation; 4.2 K

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Ti-6Al-4V; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; -423 F

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Maraging (200); tensile yield strength; fracture toughness; -423 F

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Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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Polymers; polytetrafluoroethylene; thermal expansion; -180 C

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Aluminum; copper; beryllium; niobium; electrical resistivity; 0 K

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2014-T62; Ti-6Al-4V; fracture toughness; -423 F

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Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; weld properties; fracture mechanics; fatigue properties; -320 F

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7039; Hastelloy X; Inconel 718; Ti-5Al-2.5Sn; thermal conductivity; electrical resistivity; 4 K

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Nylon; polyethylene; thermal conductivity; 4.2 K

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Aluminum alloys; Russian alloys; AK8; V92TS; D20(2219); mechanical properties; -320 F

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A-286; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; -423 F

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AISI 303; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

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Inconel 718; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; -423 F

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AISI 310; AISI 347; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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21-6-9; ultimate tensile strength; tensile yield strength; elongation; -423 F

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Inconel 718; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; impact properties; -423 F

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Niobium; thermal conductivity; 30 K

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2014-T6; Inconel 718; Ti-5Al-2.5Sn; AISI 301; fatigue properties; fracture properties; notch properties; 4 K

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2014-T6; fatigue properties; -423 F

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2014-T6; ultimate tensile strength; tensile yield strength; elongation; weld properties; -423 F

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AZ31B; ZE10A; HM31A; HM21A; HK31A; impact properties; tensile properties; stress-strain data; -424 F

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Polystyrene, thermal conductivity; specific heat; 1 K

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Nickel; nickel alloys; maraging steels; stainless steels; engineering steels; production; mechanical properties; electrical properties; thermal properties; magnetic properties; applications; -320 F

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2021-T81; ultimate tensile strength; tensile yield strength; elongation; -452 F

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Handbook; compilation; metallic materials; nonmetallic materials; mechanical properties; thermal properties; cryogenic temperature

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Ti-6Al-4V; Ti-5Al-2.5Sn; Ti-8Al-1Mo-1V; Ti-4Al-3Mo-1V; Ti-13V-11Cr-3Al; Ti-6Al-6V-2Sn; fracture toughness; crack propagation; tensile properties; -423 F

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Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; reduction in area; 140 R

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Fiberglass/epoxy composites; epoxy resins; ultimate tensile strength; elongation; notch toughness; impact properties; thermal contraction; -423 F

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Ti-4Al; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; notch tensile strength; fracture properties; weld properties; Poisson's ratio; -423 F

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Ti-47Nb; superconductivity; 4.2 K

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Aluminum; copper; nickel; molybdenum; Armco iron; AISI 1010; AISI 1030; AISI 1020; AISI 304; AISI 316; Ti-13V-11Cr-3Al; maraging steel; ultimate tensile strength; tensile yield strength; stress-strain data; 4.2 K

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Polyethylene; polystyrene; polymethylmethacrylate; polytetrafluoroethylene; polychlorotrifluoroethylene; specific heat; below 10 K

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18/8 stainless; 9Ni steel; ultimate tensile strength; tensile yield strength; elongation; creep properties; impact properties; -269 C

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Polymethylmethacrylate; strain rates; compressive properties; tensile yield strength; stress-strain data; brittle fracture; 78 K

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Electrolytic tough pitch copper; OFHC copper; magnetoresistance; 4.2 K

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Aluminum; electrical resistivity; fatigue properties; -195 C

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7039-T6151; tensile yield strength; notch tensile strength; weld properties; fracture properties; -310 F

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Polyethylene; thermal conductivity; below 1 K

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Copper; ultimate tensile strength; elongation; 77 K

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Copper; ultimate tensile strength; proof stress; shear modulus; 20 K

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Plastics; ultimate tensile strength; 4.2 K

Plastics; impact properties; 77 K

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2014-T62; 2219-T87; Ti-6Al-4V; Ti-5Al-2.5Sn; ultimate tensile strength; tensile yield strength; elongation; fracture toughness; fatigue properties; -423 F

619. Hust, J. G., "Thermal Conductivity Standard Reference Materials From 4 to 300 K. I. Armco Iron", NBS Technical Report 9740 (August 1969).

Armco iron; thermal conductivity; electrical resistivity; 4 K

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Ti-5Al-2.5Sn; 2219-T87; ultimate tensile strength; tensile yield strength; elongation; reduction in area; Poisson's ratio; modulus of elasticity; weld properties; fracture toughness; -423 F

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Polystyrene; dielectric properties; 4 K

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Metal matrix composites; Ti-Nb/Cu composite; Ti-28Nb; magnetization; superconductivity; 4.2 K

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Nb_3Sn; Ti-28Nb; magnetization; 4.2 K

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Aluminum; copper; gold; silver; thermal expansion; 2.5 K

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AISI 304L; AISI 310; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -452 F

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AISI 301; AISI 302; AISI 304; AISI 304L; AISI 305; AISI 316; AISI 309; AISI 310; AISI 330; elongation; reduction in area; strain rate; -321 F

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2219; 3003; 5083; 5454; 5456; 6061; A344; 354; C355; ultimate tensile strength; tensile yield strength; elongation; reduction in area; notch tensile strength; weld properties; -452 F

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Ti-6Al-4V; fatigue properties; -423 F

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Nb_3Sn; magnetic hysteresis; 4.2 K

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Nb_3Sn; magnetic hysteresis; 4.2 K

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Monograph; compilation; metals; compounds; superconductivity; below 1 K

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2021-T81; X7007-T6; fracture toughness; -423 F

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18Cr steel; ultimate tensile strength; tensile yield strength; elongation; notch toughness; impact properties; weld properties; -320 F

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AISI 304; AISI 304L; AISI 310; AISI 321; 18Cr steel; specific heat; 1.7 K

1970

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Filler metals; ultimate tensile strength; tensile yield strength; elongation; impact properties; weld properties; -150 F

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AISI 4340; 21-6-9; A-286; AISI 310; AISI 347; 17-4PH; Maraging (200); 9Ni steel; Inconel 718; Hastelloy X; Ti-5Al-2.5Sn; Ti-6Al-4V; ultimate tensile strength; tensile yield strength; elongation; notch tensile strength; -423 F

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Ti-6Al-4V; fracture mechanics; -320 F

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AISI 301; AISI 304L; AISI 310; ultimate tensile strength; tensile yield strength; elongation; -452 F

Beryllium; fracture toughness; -320 F

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Polystyrene; polymethylmethacrylate; specific heat; thermal conductivity; 0.4 K

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Polymethylmethacrylate; polystyrene; specifc heat; 0.5 K

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2024; 5083; 7039; Hastelloy N; Hastelloy X; Inconel X-750; Udimet 700; OFHC copper; Cu-30Zn; Cu-28Zn-1Sn; Ti-6Al-4V; Ti-13V-11Cr-3Al; AISI 304L; AISI 316; AISI 321; 17-7PH; electrical resistivity; 4 K

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Aluminum alloys; nickel alloys; copper alloys; titanium alloys; stainless steel; iron alloys; electrical resistivity; 4 K

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Titanium; titanium alloys; specific heat; 1.5 K

Titanium; titanium alloys; magnetic susceptibility; 78 K

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Copper; iron alloys; thermal expansion; 10 K

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Polymethylmethacrylate; compressive yield stress; ultimate tensile strength; -25 C

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Copper alloys; magnetic susceptibility; electrical resistivity; 77 K

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Aluminum; copper; magnetoresistance; electrical resistivity; 4 K

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Copper; thermal expansion; 20 K

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Cadmium; chromium; manganese; titanium; tungsten; vanadium; zinc; zirconium; electrical resistivity; 0 K

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Iron; thermal conductivity; 4 K

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AISI 347; thermal conductivity; electrical resistivity; 4 K

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Inconel 718; thermal conductivity; electrical resistivity; 4 K

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Invar; magnetic properties; 17 C

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Niobium; niobium alloys; thermal conductivity; 4 K

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Aluminum alloys; British alloys; HS 30 (U.S. 6061); D 74S (U.S. 7005); L 71 (U.S. 2014); Hiduminium 48 (U.S. 7039); DTD 687; 3033X; ultimate tensile strength; notch tensile strength; 20 K

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Titanium alloys; ultimate tensile strength; reduction in area; 4.2 K

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Copper; thermal expansion; 10 K

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Inconel 718; ultimate tensile strength; tensile yield strength; elongation; fracture properties; fatigue properties; -423 F

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Zirconium alloys; hafnium alloys; superconductivity; 1 K

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Iron; ultimate tensile strength; elongation; fracture properties; stress-strain data; 77 K

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2021-T81; X7007-T6; AISI 301; ultimate tensile strength; tensile yield strength; elongation; reduction in area; modulus of elasticity; Poisson's ratio; weld properties; fracture toughness; -423 F

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2021-T81; X7007-T6; AISI 301; ultimate tensile strength; tensile yield strength; elongation; reduction in area; -423 F

2021-T81; X7007-T6; modulus of elasticity; thermal expansion; 20 K

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Inconel 718; ultimate tensile strength; tensile yield strength; elongation; reduction in area; weld properties; fracture toughness; -320 F

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Metals; alloys; thermal conductivity; cryogenic temperatures

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Metals; alloys; specific heat; cryogenic temperatures

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Iron; iron alloys; magnetic permeability; 4.2 K

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Copper; aluminum; thermal expansion; 10 K

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Polymers; polymethylmethacrylate; stress-strain data; fracture properties; 78 K

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Polymethylmethacrylate; flow stress; fracture stress; plastic deformation; 78 K

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Aluminum; copper; thallium; platinum; magnetic properties; 10 K

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X2020-T8E31; ultimate tensile strength; tensile yield strength; elongation; weld properties; -423 F

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2014-T6; maraging steel; zirconium; ultimate tensile strength; tensile yield strength; elongation; weld properties; fracture toughness; 4.2 K

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Aluminum alloys; copper alloys; nickel alloys; iron alloys; titanium alloys; electrical resistivity; 4 K

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Nb_3Sn; superconductivity; 4.2 K

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Aluminum; electrical resistivity; superconductivity; magnetoresistance; 4.2 K

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Aluminum; magnetoresistance; 4 K

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Copper; microhardness; flow properties; 80 K

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2219-T87; Ti-5Al-2.5Sn; fatigue properties; fracture toughness; -423 F

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2219-T87; Ti-5Al-2.5Sn; fracture toughness; -423 F

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Copper; tensile yield strength; impact properties; stress-strain data; 77 K

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A-286; thermal conductivity; electrical resistivity; 4 K

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2024; thermal conductivity; electrical resistivity; 4 K

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22-13-5; thermal conductivity; electrical resistivity; 4 K

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Iron, thermal conductivity; 4 K

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Copper alloys; tensile yield strength; 1.6 K

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Invar; magneto-elastic properties; 20 C

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Copper; copper alloys; 18/8 stainless steel; 9Ni steel; ultimate tensile strength; elongation; reduction in area; notch tensile strength; impact properties; -196 C

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A-286; ultimate tensile strength; tensile yield strength; elongation; reduction in area; impact properties; -423 F

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Niobium; electrical resistivity; 20 K

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Polymers; thermal contraction; thermal conductivity; specific heat; electrical resistivity; 4.2 K

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Engineering steel; 25Mn-5Cr-1Ni steel; ultimate tensile strength; Charpy impact; toughness properties; elongation; thermal expansion; -196 C

FIRST AUTHOR INDEX

SUBJECT INDEX

MECHANICAL PROPERTIES

ALUMINUM AND ALUMINUM ALLOYS

MANGANESE AND MANGANESE ALLOYS

MOLYBDENUM AND MOLYBDENUM ALLOYS

NICKEL AND NICKEL ALLOYS

NIOBIUM AND NIOBIUM ALLOYS AND COMPOUNDS

POLYMERS

STEEL–STAINLESS

THERMAL PROPERTIES

ALUMINUM AND ALUMINUM ALLOYS

BERYLLIUM AND BERYLLIUM ALLOYS

BISMUTH

GALLIUM

GERMANIUM AND GERMANIUM ALLOYS

MANGANESE AND MANGANESE ALLOYS

MERCURY

MOLYBDENUM AND MOLYBDENUM ALLOYS

NICKEL AND NICKEL ALLOYS

NIOBIUM AND NIOBIUM ALLOYS AND COMPOUNDS

OSMIUM

PALLADIUM

PLATINUM

POLYMERS

STEEL–STAINLESS

TANTALUM AND TANTALUM ALLOYS

THALLIUM

ELECTRICAL PROPERTIES

ALUMINUM AND ALUMINUM ALLOYS

Aluminum (unalloyed)–3, 23, 28, 65, 155, 259, 360, 371, 394, 439, 465, 518, 574, 612, 650, 686, 687, 804, 830, 923
1100 Aluminum–98, 120, 164
Aluminum Alloys (general)–645, 681, 731
2024–98, 120, 164, 644, 697, 724
3003–98, 120
5052–98, 120, 164
5056–724
5083–120, 644, 724
5086–120
5154–98, 120, 164
5456–724
6061–923
6063–98, 120, 164
7039–577, 644, 693
7075–669

BERYLLIUM AND BERYLLIUM ALLOYS

Beryllium (unalloyed)–574

CADMIUM

Cadmium (unalloyed)–653

CERAMIC MATERIALS

Graphite–241
Lead Pyroniobate–958

CHROMIUM AND CHROMIUM ALLOYS

Chromium (unalloyed)–83, 653

COBALT AND COBALT ALLOYS

Cobalt (unalloyed)–23, 83, 155
Cobalt Alloys (general)–799
L-605–241

COMPOSITES

COPPER AND COPPER ALLOYS

GERMANIUM AND GERMANIUM ALLOYS

GOLD AND GOLD ALLOYS

STEEL–STAINLESS

TANTALUM AND TANTALUM ALLOYS

THALLIUM

TIN

TITANIUM AND TITANIUM ALLOYS

TUNGSTEN AND TUNGSTEN ALLOYS

VANADIUM AND VANADIUM ALLOYS AND COMPOUNDS

ZINC AND ZINC ALLOYS

ZIRCONIUM AND ZIRCONIUM ALLOYS

MAGNETIC PROPERTIES

ALUMINUM AND ALUMINUM ALLOYS

CERAMIC MATERIALS

CHROMIUM AND CHROMIUM ALLOYS

COBALT AND COBALT ALLOYS

COMPOSITES

COPPER AND COPPER ALLOYS

GERMANIUM AND GERMANIUM ALLOYS

GOLD AND GOLD ALLOYS

INDIUM

IRON AND IRON ALLOYS

MAGNESIUM AND MAGNESIUM ALLOYS

MANGANESE AND MANGANESE ALLOYS

MOLYBDENUM AND MOLYBDENUM ALLOYS

NICKEL AND NICKEL ALLOYS

VANADIUM AND VANADIUM COMPOUNDS

ZINC AND ZINC ALLOYS